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Characteristics of human-elephant conflict in agrarian villages at Bogahapalassa Forest Reserve in Sri Lanka

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Tiivistelmä – Referat – Abstract

Ihmisten ja norsujen väliset konfliktit uhkaavat sekä norsupopulaatioiden elinvoimaisuutta että tämän suojellun lajin läheisyydessä elävien ihmisten hyvinvointia. Ongelmat ovat tyypillisiä erityisesti sellaisilla maaseudun alueilla, joilla ihmisasutus ja maanviljely ovat levinneet norsujen esiintymisalueelle ja missä viljelyalueet reunustavat jäljellä olevaa norsujen elinympäristöä. Sri Lanka on yksi niistä maista, joissa ihmisten ja norsujen käyttämät alueet monin pakoin risteävät, ja missä norsut aiheuttavat huomattavia haasteita maaseudun yhteisöille.

Tässä tutkimuksessa tarkastellaan ihmisten ja norsujen välistä konfliktia Bogahapalassan metsäsuojelualueella eteläisessä Sri Lankassa. Sen sijaan että tutkimus keskittyisi norsujen suojeluun liittyviin haasteisiin, kiinnostuksen kohteenani on norsukonfliktin vaikutus paikallisten yhteisöjen elämään. Tutkimuksessani pyrin selvittämään missä, milloin ja miten norsuongelmia esiintyy. Tarkastelussa on erityisesti konfliktin esiintymisen alueelliset erot, käytettyjen konfliktin hallintastrategioiden haasteet, sekä eri toimijoiden näkemykset konfliktin syistä ja ratkaisuista. Tutkimusalueeseen kuuluu 28 maaseudun kylää, jotka sijaitsevat suojelualueiden läheisyydessä. Tutkimus on toteutettu kvalitatiivisia metodeja käyttäen. Aineisto on kerätty ryhmähaastatteluilla kyläläisten kanssa sekä haastattelemalla erikseen yksittäisiä avainhenkilöitä. Aineiston analyysissa on käytetty laadullista sisällön analyysia.

Tutkimustulokset osoittavat, että ihmisten ja norsujen välisiä ongelmia esiintyy koko tutkimusalueella ilman huomattavia eroja eri kylien välillä. Ilmiö on ympärivuotinen, joskin pahimmillaan ongelmat ovat kuivan kauden aikaan. Norsut aiheuttavat kyläläisille useita suoria sekä epäsuoria haittoja. Merkittävimmät ongelmat liittyvät norsujen aiheuttamiin satotuhoihin, jotka suurin osa kyläläisistä kokevat laajuudeltaan vakaviksi. Norsukonfliktin taustalla on luonnon alueen kutistuminen ja huonontuminen ihmisten toiminnan aiheuttaman jatkuvan paineen alla. Tämän lisäksi ongelmia aiheuttaa tänä päivänä Lantanaksi kutsutun tulokaslajin leviäminen, jonka seurauksena norsujen ravintonaan käyttämät kotoperäiset kasvilajit käyvät vähäisemmiksi. Useat haastateltavat uskoivat myös, että ongelmat lisääntyvät koska norsut ovat kasvavissa määrin tottuneet etsimään ruokaa kylistä eivätkä ne enää välitä erilaista pelotteista.

Alueella on käytössä useita erilaisia keinoja norsujen aiheuttamien ongelmien hillitsemiseksi. Suuri osa näistä näyttää menettävän tehoaan, minkä täytyy osaltaan vaikuttaa sähköaitojen suureen suosioon. Sähköaitaaminen on tällä hetkellä hallitseva virallinen strategia norsuongelmien ehkäisemiseksi. Niissä kylissä, joissa valtion luonnonsuojeluosaston pystyttämä sähköaita oli jo käytössä, ihmiset kertoivat useista aitaan liittyvistä puutteista. Tulosten perusteella on selvää, että nykyiset konfliktin ehkäisyyn käytetyt strategiat eivät pysty tehokkaasti vähentämään norsujen aiheuttamia ongelmia. Alueelle tarvitaan siten lisää muita monipuolisia konfliktin hallintastrategioita, jotta tilanteeseen voitaisiin puuttua kestävästi.

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Sri Lanka, Bogahapalassa, villieläinkonflikti, norsukonflikti, luonnonsuojelu

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Tiivistelmä – Referat – Abstract

Human-elephant conflicts (HECs) pose a threat for both the survival of elephant populations and for the wellbeing of the rural people who live adjacent to wildlife. Problems are common especially in those rural areas where human settlements and agriculture have expanded on elephant ranges and where agricultural villages border the remaining elephant habitats. Sri Lanka is one of the countries where human and elephant territories commonly overlap and where the presence of elephants causes serious challenges for the rural communities.

This paper presents a study of human-elephant conflict at Bogahapalassa forest reserve in south-central Sri Lanka. Instead of studying HEC as a hindrance to elephant conservation I was interested of its impact on the local communities. The aim was to find out where, when and how this conflict takes place. The study focuses on areal differences in HEC's prevalence, on the challenges of the used mitigation strategies, and examines the perceived causes and solutions for the elephant issue. The study area comprised 28 agrarian villages that are located adjacent to protected areas. The research was conducted using qualitative methods. We carried out group interviews with the inhabitants of the studied villages and individual interviews with different key informants. The collected data was later analysed using qualitative content analysis.

The results show that human-elephant conflict takes place in all the studied villages without clear areal differences. Elephants cause problems around the year but especially during the dry season. The villagers suffer of various direct and indirect hindrances. The major cost of the conflict comes from crop losses that were commonly perceived as serious hindrance for livelihoods. The HEC has its roots in the shrinkage and deterioration of the forest areas that have been under continuous pressure from human activities. An invasive flowering species called Lantana is also spreading in the forests replacing native eatable grasses, therefore further decreasing the available food sources for elephants. It was also commonly believed that elephants are becoming increasingly used to crop raiding and to the deterrent methods that villagers use and thus the situation is worsening.

There are various mitigation strategies being used to tackle the issues with elephants. Most of these seemed to be losing their effectiveness which must party contribute to the strong support of electric fencing that is now the main official strategy for HEC mitigation in this area. The villages that already have the electric fence from the Department of Wildlife Conservation reported various deficiencies in the fence. It is clear that the mitigation strategies that are currently being used are not sufficient to solve or effectively reduce the issues with elephants. Thus, other multi-pronged strategies need to be tested and implemented to sustainably mitigate the HEC.

Avainsanat – Nyckelord – Keywords

Sri Lanka, Bogahapalassa, human-wildlife conflict, human-elephant conflict, conservation

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Abbreviations

CEJ	Centre for Environmental Justice
DWC	Department for Wildlife Conservation
ECA	Elephant Conservation Area
ECU	Elephant Control Unit
FD	Forest Department
HEC	Human-Elephant Conflict
HWC	Human-Wildlife Conflict
IUCN	International Union for Conservation of Nature
MER	Managed Elephant Range
NTFP	Non-timber Forest Product
UNDP	United Nations Development Programme
WWF	World Wildlife Fund

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I wish to begin this paper by thanking Shalin Finland first of all for proposing the idea to research the elephant issues at Bogahapalassa. Because of Shalin's incentive and interest to include a thesis student for this project I got to study this particularly interesting topic. The help that I have received throughout the process has been precious. Your support was crucial especially when planning the research and during the trip to Sri Lanka.

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1. Introduction

"Elephant conservation in Sri Lanka should not simply be a matter of protecting the charismatic species; it should also be about the wellbeing and survival of the people who share their land with elephants." (DWC 2006).

1.1 Background

People and wildlife live side by side in many parts of the world. This coexistence takes place both in rural and urban spaces, though substantially more in the former. Quite often it is inconspicuous but in some areas the human-wildlife interaction is frequent and notable. This is especially the case in rural areas where humans and wildlife come to utilize the same resources. Coexistence does not necessary cause any trouble. It can even be beneficial for both sides, but when territories or resources are competed issues might rise. With some species even the mere sharing of space might not be tolerated, especially if this causes danger to human lives, property or wellbeing. When the needs and behaviour of wildlife contradicts with the goals of humans' coexistence can easily turn into conflict. The ability of humans to dominate animals has traditionally led to greater losses for wildlife, to the extent of extinction of some species, but with the more complex human-wildlife relation of today the issues have become more intricate. The recognition of wildlife and its value, to the extent of granting legal protection to some species, has limited the ways how people can deal with the problems caused by wild animals.

Human-wildlife conflict (HWC) can be defined as "any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife populations, or on the environment" (World Wildlife Fund 2005: 6). Conflicts between humans and wildlife cause problems for both sides. Habitat destruction, poaching and problem-animal control by killing are the main threats posed on wildlife. The spread of human settlement and activities like agriculture, resource extraction and energy production have long been engulfing natural habitats. Wildlife has also posed various challenges for humans. Some animals can threaten human lives or more commonly their livestock. Many species strive to get their shares of the crops cultivated by farmers in all continents, causing crop losses of various scales. Animals can also cause different types of property damages or simply annoyance, which has been a cause of a conflict for example with primates in some Asian cities (e.g. Yeo & Neo 2010).

HWC conflict has significantly contributed to the need to protect several species. Simultaneously the conservation of certain species has for its own part made it more difficult for people to respond to the hindrance that these animals pose to them. When killing of an animal is not allowed, being either illegal or religiously or socially unacceptable, more complex measures must be adopted to counter the issues. Different species pose different kind of challenges and even with same species the nature of the conflict can vary significantly from a situation to another. This makes human-wildlife conflicts difficult to solve, as universally capable explanations and solutions are infeasible (Johansson 2008; Madden 2010; Ekanayaka et al. 2011).

Human-wildlife conflicts have a long history, expanding from present day to the prehistoric times when people were still prey for some wild animals. The recordings of these conflicts span to pre-colonial times, when for example in Africa crop raiding by elephants and other large animals caused food shortages and displaced settlements, sometimes preventing agriculture altogether (Naughton-Treves & Treves 2005: 253). The conflicts with wildlife are also by no means ceasing. Instead, recent trends suggest that HWC is increasing both in frequency and severity world-wide as land and resources are ever more needed for the growing human population and further development (Madden 2010). HWC is one of the most critical threats facing many wildlife species today and consequently the topic is receiving increasing attention (Evans & Adams 2016). There is plenty of HWC literature that concentrates in conservation issues by studying conflicts' impact on wildlife and conservation efforts. Somewhat less attention has been rewarded for the people who suffer due to HWC. The conflict needs to be addressed also from the point of view of these people as it can have clear detrimental effect on their wellbeing. This study aims to addresses the issue of human-elephant conflict (HEC) precisely from this viewpoint.

Elephants are one of the most widely studied species in HWC literature (e.g. Mackenzie 2012; Debata et al. 2013; Nath et al. 2013; Rohini et al. 2015; Palei & Singh 2016). Human-elephant conflicts take place both in the African and Asian elephant ranges. In the worst affected regions HEC can seriously hinder the everyday lives of local farmers. Due to their large size, elephants are capable of destroying vast areas of crops in a relatively short time. Farmers can even loose the season's whole harvest in one night if a raid goes unnoticed. Elephants can also severely injure and even kill people when they feel threaten. Each year hundreds of farmers fall victim to elephant attacks in Africa and Asia (e.g. Perera 2009: 43−45).

According to Lee and Graham (2006: 216) HEC is among the most emotive and political forms of human-wildlife conflict. Elephants can be seen as serious and dangerous crop pests that need to be controlled. On the other hand, they are perceived culturally valuable in many countries and internationally elephant has an iconic status as widely revered creature, wildlife at its best, and there is a strong position that they should be protected. (Lee & Graham 2006). The opinions naturally differ between different stakeholders depending on the relation that each one has with elephants. A farmer that suffers crop raiding is likely to have contrasting views with a foreign conservationist. As conservation is driven by national and international organizations and other relatively powerful actors the opinions of local communities are at risk of being unnoticed. This can further create tension between farmer communities, authorities and conservationists. To avoid human-elephant conflict expanding to "human-human conflict" the views of all stakeholders should be addressed. There is a need to balance between conservation efforts and the requirements of local communities. I have strived to scope multiple views of HEC from different stakeholders in this study yet giving the central focus to the experiences of the local communities.

Sri Lanka is one of the countries where humans confront elephants frequently. It is estimated that Sri Lanka has the highest density of Asian elephants, with roughly 5–10 percent of the total population inhabiting the island state (Fernando et al. 2005; Choudhury et al. 2008). A big part of the country's rural inhabitants resides in areas where elephants are present. In some places elephants might interfere in people's lives nearly every day. HEC can be a serious burden especially for those families that engage in agriculture, which still employs 27.1 percent of Sri Lankan workforce though the number has been dropping steadily in the past years (Sri Lanka Labour Force Survey 2016). Besides complicating the lives of many Sri Lankan farmers, human-elephant conflict is the main challenge for the conservation of Asian elephants in Sri Lanka.

1.2 Purpose of the study

This paper presents a case study of human-elephant conflict in agrarian villages located at Bogahapalassa Forest Reserve in south-central Sri Lanka. The study area, which will be presented in more detail later, consist of a mosaic of protected areas with dozens of agrarian villages adjacent to them. The purpose of the study is to assess the characteristics of HEC at the Bogahapalassa Forest Reserve with a focus on the impact that it has on human lives. As part of

the study I have surveyed the perceived severity of and reasons for the conflict, strived to evaluate the used and proposed mitigation strategies, and partially examined the possible animosity between different stakeholders involved in the elephant issue. The study objectives will be defined in more detail in chapter 4.

The idea to study human-elephant conflict in this area was first proposed by a Finnish development NGO Shalin Finland. Together with their Sri Lankan partner Centre for Environmental Justice (CEJ) the two organizations have been conducting a project called Community participation for improved forest governance in Sri Lanka since 2014. The project aims to solve the areal issues of "deterioration and clearing of protected natural forests and changing land use in the selected project sites, and the various negative effects this is posing to the communities." (Shalin Finland 2014: 1). The main negative effects of the destructive activities have been the reduction of water sources and increased occurrence of floods and droughts. The adverse developments in the forest area have also lead to an intensified human-elephant conflict which is causing severe damage to cultivations and other property in the conflict sites. The project takes place in two areas: Nilgala and Bogahapalassa forest reserves. This study was conducted in the latter. According to Shalin Sri Lanka project working group there is no serious elephant problem in Nilgala and thus the phenomenon needed to be studied only in Bogahapalassa. (Shalin Finland 2014; Shalin Finland 2016)

A baseline survey made by CEJ found out that HEC is widespread around Bogahapalassa. In fact, people ranked it the most severe of forest related problems, worse than forest fires, water related issues or any of the illegal activities taking place in the forest (Fig. 1). HEC is known to be emotive and people tend to exaggerate its importance but nevertheless the results suggest that the conflict is severe in the area. According to the CEJ's report on background information (2015) most of the people in Bogahapalassa believe that village economies cannot be improved before the elephant issue has been solved. The study area around Bogahapalassa is presented after the next chapter that defines the theoretical background for this study.

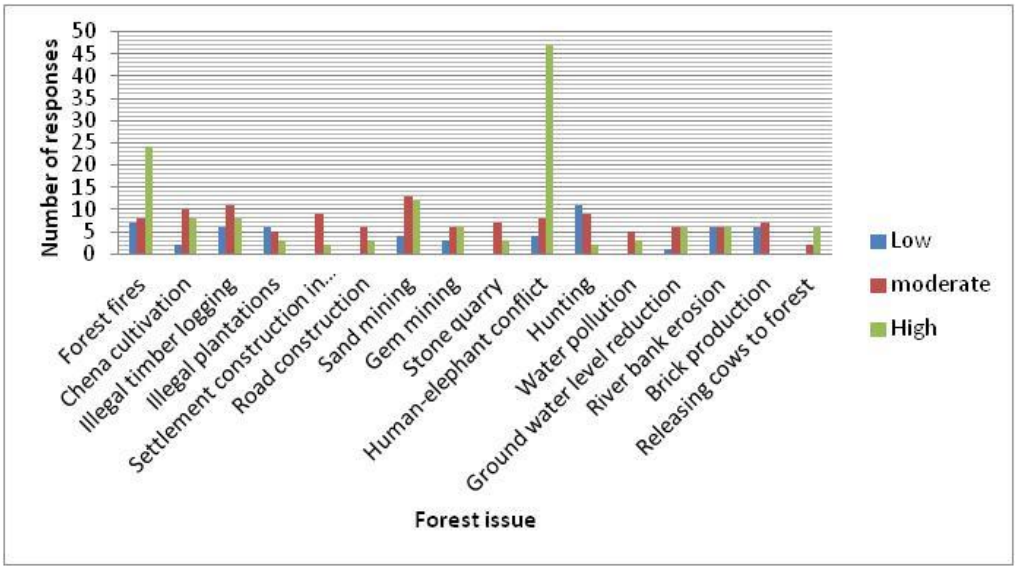

Figure 1. Ranking of forest related issues in Bogahapalassa. (Centre for Environmental Justice 2015)

1.3 Theoretical background

This study stems from the field of "new" animal geography. The "new" animal geography has been broadly defined by Julie Urbanik (2012: 38) as "the study of where, when, why and how nonhuman animals intersect with human societies". Animals have been part of geographical studies already for long but the "new wave" of animal geography differs notably from the past work of geographers on animals.

In the early times of geography as an academic discipline zoogeography emerged as the first branch of geography to concentrate in studying animals. The focus of this branch was in the distribution of different animal species on earth, and the mutual influence of animals and nature upon each other. Animals were seen solely as natural objects that were to be studied separately from humans. The so called first wave of animal geography that lasted from the late nineteenth century to the middle of the twentieth had focal emphasis on zoogeography but later also a secondary interest in human-animal interactions. An example of this is the book Ecological Animal Geography (1973) from W. C. Allee and Karl P. Schmidt that included a chapter called "The effect of man in the distribution of animals" (the book is based on Richard Hesse's Tiergeographie auf ökologischer Grundlage from 1924). The focus on human-animal relations in space and place came to the centre of animal geography in its second wave, while in the mid twentieth century biology and zoology started to take over the work of cataloguing animal species and their distributions. Animals were not to be studied anymore separately from humans but in relation to them. The second wave animal geographers were mostly interested in the

impact of humans on wild animals and in human relations with livestock. Their work was influenced by the study of cultural landscapes as cultural ecology, how human cultures shape and are shaped by their environment, which involved addressing the issue of human-animal relations. But this was still primary through studying domestication with the view of animals as objects under human domination. (Urbanik 2012: 23–33)

Charles F. Bennet took animal geography a step further by introducing a new approach that he named cultural animal geography. He called for an increased appreciation of the importance of animals as an element in landscape. The task of cultural animal geography he defined as to "accumulate, analyse and systematize data relevant to the interactions of animals and human cultures" (Bennet 1960: 13). Bennet expanded the focus of animal geography broader from domesticated animals to the multiple ways how humans and animals impact each other. One thing relevant to HWC studies that he pointed out was the need to study how animals affected human life opportunities and the dangers that animals potentially pose on humans and their livelihoods (Wolch 2002: 724). What Urbanik (2012: 36–43) calls the third wave or "new" animal geography builds partly on top of the ideas proposed by Bennet. This step of animal geography taken in the mid-1990s expanded the notion of human-animal relations beyond the domesticated livestock to include all locations of human-animal encounters, also those with wildlife. It also attempts to decentre humans as the focal subject by recognizing the agency of nonhumans: the animals themselves are subjects of their own lives instead of just being objects of human control. Animals can affect human lives even willingly through their own action, thus it is not only humans that can impact the lives of animals. From this notion we can proceed to study the ways how wildlife affects the lives of humans even in conflicting ways.

1.4 Study area

1.4.1 The greater area around Bogahapalassa

Bogahapalassa forest reserve is located in Haldummulla Divisional Secretariat of Badulla District in south-central Sri Lanka. It gained its Reserved Forest status in 2013. The forest consists of four different forest types: moist monsoon, dry monsoon, savannah and riverine dry forest. The diversity of the environment has contributed to the rich biodiversity of the forest. The terrain is hilly with elevation ranging between 121 to 762 meters (Forest Department 2016). The higher altitude areas are located mostly in the northern part where as the area in south if

generally flat (Fig. 2). The annual rainfall varies from 1500mm to 2500mm. This part of the country receives rainfall from both monsoons (including Southwest monsoon in May to September) but most of rains come during the Northeast monsoon season in December to February.

The forest has suffered deforestation and degradation due to human activities. The situation has improved after enforcing the forest protection but some illegal activities like logging and slash and burn type *chena* cultivations still take place in the reserve. CEJ's survey results showed that around 15.6 percent of the families with family cultivations do chena or other type of cultivations inside or near the forest boundary while only 23 percent of them have permits. The forest also suffers from regular forest fires and spreading of invasive species like a flowering plant called Lantana (Forest Department 2016).

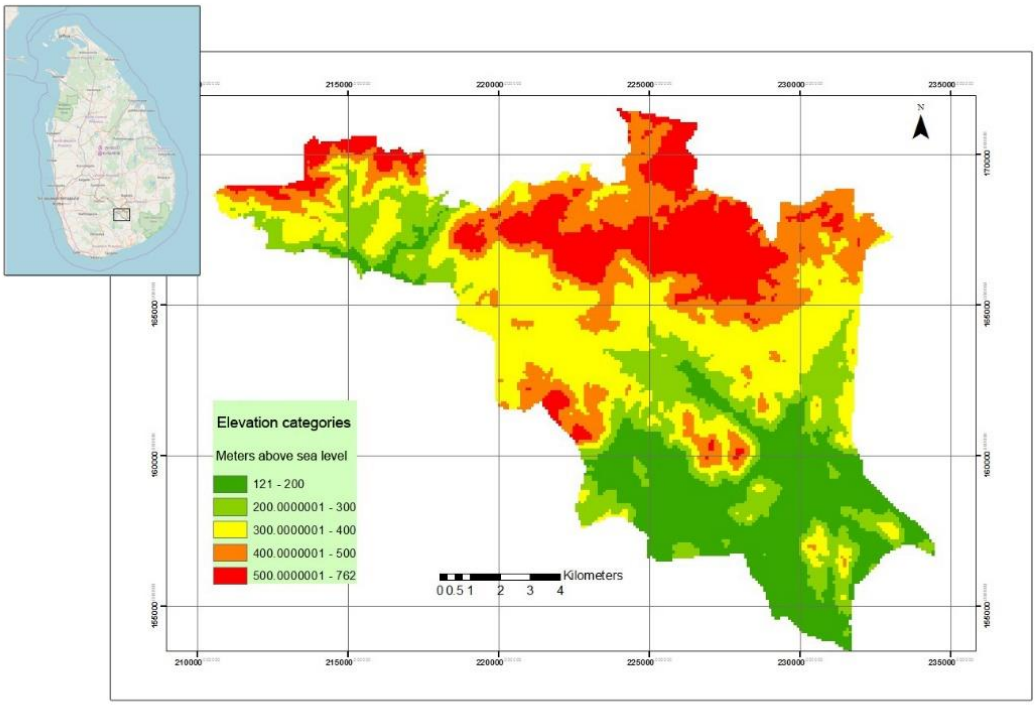

Figure 2. Elevation categories of Bogahapalassa forest reserve. (Forest Department 2016)

There are two other natural areas with protection status next to Bogahapalassa. The famous Udawalawe National Park (sometimes written Uda Walawe) is located south from Bogahapalassa. It is especially well-known for its elephant population. The park encompasses a total surface area of nearly 3500 hectares which constitutes an important part of the interconnected wildlife habitats (Udawalawe Facts 2014). According to de Silva et al. (2011) the total elephant population of the park was estimated to be between 804 and 1160 individuals.

Udawalawe is among the top most visited national parks in Sri Lanka and as such it has a big importance for the tourism sector of the country (Udawalawe Facts 2014). The park is linked to Bogahapalassa through Dahaiyagala sanctuary. Dahaiyagala is an official wildlife corridor established in the traditional migratory paths of elephants (Shalin Finland 2014). This corridor is frequently used by elephants that forage between Udawalawe and Bogahapalassa.

The actual study area is mostly located outside of these protected areas. According to CEJ (2015) there are 69 villages located in the greater area of Bogahapalassa. Few of the villages are inside the reserve's borders despite of its protected status. These villages already existed before the declaration of the reserve and were left to stay. Based on the CEJ's survey results there were 9959 households in those 69 villages. In the Sri Lanka's Forest Department's (FD) forest management plan (2016) 2123 families are mentioned to live around Bogahapalassa forest reserve with a total population of 10332. It is unclear how FD has defined this area. It does not correspond with the 69 villages surveyed by CEJ and thus it is better to treat these numbers as a rough estimate of the population size in the study area. Forest Department must have used more confined area in their definition whereas some of the villages counted by CEJ seem to be located more than 10 kilometres away from the reserve's border.

The main occupation in the area is farming. According to the Forest management plan (2016) 52.7 percent of the villagers earned their living from agriculture. People grow both annual crops and perennials. Rice, corn, cassava, sugarcane, cinnamon, banana, coconut, rubber and pepper are some of the most typical crops grown in the villages. Large paddy fields are typical in the flatter southern part of the area where as in north there are many pepper and rubber plantations due to more suitable conditions for these plants. Most of the families have home gardens for fruits and vegetables. In addition, some farmers practise chena cultivation. CEJ's survey showed that almost all the families have some type of cultivations. Some of the families do cultivations just for part of the year and out of this season some family members enrol in other jobs, for example in mining, construction or extraction of non-timber forest products (NTFP). NTFP's, such as fire wood, medicinal plants and spices, are important for some families, not only for home use but also as a source of income. In Badulla district, the mean household income in 2013 was 36119 rupees and median 25067 rupees per month, equivalents of 198 and 138 euros with current (22.9.2017) exchange rate. In rural areas the income level is generally smaller (Household Income and Expenditure survey - 2012/13 Final Results 2014). (Centre for Environmental Justice 2015; Forest Department 2016).

Table 1. Employment distribution in the adjoining villages of Bagahapalassa (Forest Department 2016).

Occupation	**Percentage**
Farming	52.7
Government	17.3
Self-Employments	5.1
Private Sector	7.1
Other	17.8

1.4.2 Visited villages

The interconnectedness of this study with Shalin's and CEJ's forest management programme largely defined the study area. As the intention was to study HEC in the whole Bogahapalassa, most of the villages in this area were included in the study. However, we chose to survey only the villages that are near the forest border as elephants rarely move far from that. The villages that are in the three-kilometre buffer zone from Bogahapalassa (and mentioned in the NGOs' project) were decided to be included. I also decided to extend the study area to the adjoining Dahiyagala sanctuary on the southern side of Bogahapalassa, as it important in linking Bogahapalassa to Udawalawe natural park and it runs through the agricultural zone where big part of the villages are clustered. Thus the three-kilometre buffer is extended here to include the villages that lie further from Bogahapalassa's border but close to the sanctuary. A total of 28 villages were visited in the end during a six-week period in February to March 2017. There were no clear markings of the villages or their borders which would have made it difficult to find each of them without the help of local guides. Besides the CEJ's staff themselves we received help from the Forest Department (FD) officials and local contacts that were well informed of the area. Some of the villages could be divided into even smaller separate population centres like for example Madabadda LDO and Madabadda Samagipura, or the four different areas of Aluthwela shown in the map below, but in this study areas like these are considered together as one village.

Figure 3. GPS locations of the village interviews. The visited villages are located near Dahiyagala and Bogahapalassa, some even inside the demarcated forest reserve borders.

2. The varying nature of conflict with wildlife

2.1 Human-wildlife conflicts

Human-wildlife conflicts (HWCs) have been studied across varying bio-geographical regions in a multitude of situations. People face wildlife both in urban and rural areas around the world, but HWCs are clearly more common close to protected areas where wildlife densities are higher. Problems arise especially in those places where people practise farming close to PAs. Most of HWC zones are in tropics and developing countries where agriculture is often an important part of rural livelihoods (Distefano 2003).

Since HWC poses a critical threat to the survival of many endangered species, particularly for large mammals, most of the attention in HWC literature has centred on protected species (Naughton-Treves & Treves 2005). Research have been conducted by practitioners of various fields: zoologists, ecologists, biologists, conservationists and geographers −to name the most. Conflicts between people and wildlife have been studied mostly through the imperatives of

conservation (Barua 2014: 928). This work characteristically examines the drivers of conflict and the possible solutions to it, with an aim to protect the animals in danger. Although the conflict is primarily seen as a conservation issue many of these studies incorporate the human experience too, as the success of conservation is often dependent of people's reactions to the conflict and of their support for the conservation action. HWC has been less commonly treated as a social, socioeconomic or political issue that hinders the livelihoods of local people and at times even creates conflict between groups of people. Some researchers have focused more on these aspects, particularly by measuring the costs of HWC in form of livestock or crop losses and property damage. Others have dug deeper by studying the multitude of political and socioeconomic structures and processes that influence the workings and outcomes of HWCs. I will next introduce some general findings in HWC literature that are relevant for this study that focuses mostly on the impact that HEC has on local people and on the ways how these conflicts can be mitigated.

2.1.1 The significance of perceptions

Many studies have focused on the views and opinions that people have of HWCs (e.g. Naughton-Treves & Treves 2005; Linkie et al. 2007; Nath et al. 2015). Knowing these can help to understand the reaction of people and for example to build tolerance towards wildlife. People's perceptions of wildlife are shaped by diverse social and cultural factors from ethnicity to religious affiliation and other cultural beliefs (Dickman 2010: 458). Naturally the economic benefits or drawbacks associated with wildlife also shape these perceptions. These form the base for human-wildlife relation which is further affected by the interaction between the two. In situations of conflict people's attitudes typically turn against wildlife. The views tend to turn negative especially when there is nothing to be gained from the presence of the problematic species and if the losses suffered to wildlife are not intermediated by any other measures. For example, if the crop raiding animal is a highly valued pray in local communities or an important attraction for tourism revenues, then crop losses are typically better tolerated. The presence of insurance or compensation programs also makes losses generally more acceptable. On the other hand, local intolerance of wildlife may be amplified by institutional constraints on coping strategies. When people can respond to the conflict freely with any measures that they are capable of using, including lethal control, the situation is usually tolerated better as people themselves possess the control over wildlife. But conservation usually leads to constrains that

can make people more vulnerable to wild animals' incursions. Farmers feel typically more vulnerable to large, highly symbolic animals that are perceived to belong to the government when they are protected by conservation laws (Madden 2010; Naughton-Treves & Treves 2005: 267).

The attitudes that people have towards wildlife and their perceptions of conflict are not only significant for the conservation outcome, but they can also affect the relations between the groups of people involved. For example, if local farmers do not value the conserved species and their conservation efforts while these animals damage their crops frequently, the apathy towards conservation laws and authorities tends to grow. This is especially the case if the affected people feel that the authorities are not taking care of the issues that local people face in the conflict. Controversies between different stakeholders might also lead to a situation in which some more neglected groups have to bear the costs disproportionately. Dickman (2010: 458) points out that "human–wildlife conflicts are often manifestations of underlying human–human conflicts, such as between authorities and local people, or between people of different cultural backgrounds.". For the mitigation solutions to be sustainable, it can be vital to understand the underlying differences in views and opinions of the different actors involved in HWC.

2.1.2 Impact of HWCs

Human-wildlife conflict poses several threats on both animals and humans. The conflict can lead to destruction of wildlife habitat and in the worst case direct killing of animals. Human-induced mortality has taken many species to the brink of extinction and in parts of the world continuing HWC hampers the efforts to protect the remaining parts of populations. High mortality does not only affect the population viability of the species, but it has broader environmental impacts on ecosystem equilibrium and biodiversity preservation (Distefano 2003: 1). I will not go into more details of how HWC influences wildlife as the focus in this study is on humans. Instead, the rest of this chapter focuses on the ways how wildlife can disturb the lives of local people.

Human-wildlife conflict can undermine human welfare, health and safety, and have economic and social costs. Crop damage by raiding wildlife in the farms adjacent to protected areas is the most prevalent form of conflict cost for humans. Depending of the raiding animal, the losses

might be anything between small and gradual to huge and sudden with varying degree of burden to the affected farmers. Besides crop raiding, economic losses might occur from animals destroying infrastructure and other property, or by losing livestock to predatory attacks. Human wellbeing can also be in danger of animal attacks or spreading of zoonotic diseases through encounters with wildlife (Distefano 2003). World Wildlife Fund's (WWF's) Human Wildlife Conflict Manual (2005: 6−7) sums up the most typical of these direct costs that HWC poses on communities living adjacent to wild animals:

- Raiding and destruction of food crops
- Loss of income from sales of produce from cash crops
- Damage to water sources and installations
- Damage to stored produce
- Loss of livestock
- Property damage
- Human injury or death

Measuring losses is important for HWC management but several studies have shown that it can also be misleading in many ways (Naughton-Treves & Treves 2005). The simplest way to assess the extent of crop damage is through interviews and questionnaires (e.g. Thaufeek et al. 2014; Santiapillai et al. 2010) or by using official records (e.g. Palei & Singh 2016; Palei et al. 2013). This can be useful if time and other resources cannot permit more thorough evaluation, but farmers' reports and official records are usually the most biased source of information of the extent of crop raiding. Big part of crop losses goes typically unrecorded, especially if compensation schemes are absent and thus people do not see any need to report the losses. On the other hand, when the amount of crop raiding is freely defined by the farmers themselves in interviews or questionnaires, the respondents in such studies often hope for compensation and thus may exaggerate the amount of losses, particularly for large or highly symbolic species (Naughton-Treves & Treves 2005: 258). This must be kept in consideration when assessing the extent of damages from farmers' responses.

A more accurate measurement of losses needs systematic field visits in which the actual losses can be verified. This is typically time and resource consuming as the monitoring should happen over several months and often with the help of hired enumerators (e.g. Linkie et al. 2006; Êmpos-Arceiz et al. 2009; Ekanayaka et al. 2011). The results from this kind of study are much more accurate as the risk of over-reporting is minimized. But even these results can be

misleading. Regarding total amount of losses in an area hides the reality in which individual families are affected differently, with usually only part of them (mostly the ones living closest to the forest boundary) suffering the losses while others are left intact. It might be more justified to consider the average losses that the affected families experienced but this is still not completely problem free. Given the spatial and temporal complexity of peasant agricultural systems, calculating average crop losses is not only difficult but also misleading if the differences in families' vulnerability are not considered. One family may easily tolerate 20 percent loss in rice yield while for other the same can be devastating. The ability to absorb the risk of crop losses is typically strongly related to material wealth, particularly landholding size, and usually in a lesser extent to the strength of collective safety nets and even political influence. (Naughton & Treves 1999: 13; Naughton-Treves & Treves 2005: 256−257)

The conflict with wildlife can also have some less obvious impact on people's lives. Members of local communities who live in areas of frequent HWC often suffer from a sense of insecurity. This might be due to the physical threat of animal attacks or stem from the stress of potentially suffering losses to wildlife. In some cases, the whole season's earnings can be lost in a single night for crop raiding animals if the fields are left unguarded. Also guarding itself causes indirect costs on people. It results in the reduction of sleep and in some areas to higher exposure to diseases like malaria. This can further cause a loss of productivity and opportunities to pursue other economic activities or education. Children might skip school because they need to guard the crops. The presence of wildlife can also restrict the freedom of movement and access to resources such as water and firewood because the risk of running into a dangerous animal is too high. The costs of human-wildlife conflicts are typically suffered by individuals and families who live adjacent to the trouble causing animals whereas the benefits of conserving these species are received by larger and more distant communities in local, regional, country and/or global level (WWF 2005: 7−8).

2.1.3 General causes for HWC and strategies to mitigate it

The reasons and outcomes of HWCs are typically case specific but there are some global trends that have contributed to the escalation of HWC worldwide. Following S.K. Palita and K.L. Purohit (2008: 87) these can be grouped into human population growth, increased demand of energy and other resources, land use transformation, growing pressure for access to land, species habitat loss or degradation and fragmentation, growing interest in ecotourism and

increasing access to nature reserves, increasing livestock populations and competitive exclusion of wild herbivores, abundance and distribution of wild prey, increasing wildlife population as a result of conservation programmes, climatic factors and other stochastic events.

A wide range of HWC management tools have been developed worldwide, many of which are strongly site or species specific. The strategies share similar goals, but they are embedded in different ecological, social, cultural and economic realities, and they are targeted towards different animal groups (Distefano 2003). As human-wildlife conflicts are highly variable globally applicable single solutions are not feasible. In all cases a combination of management options is needed. For the strategies to be sustainable, they need to match the financial and technical capabilities of the local communities and individuals responsible of conflict management. The institutional arrangements and policies from national to local level also partly determine which management options are available (WWF 2005). I will next scrutinise some general strategies that have been presented in the literature. The following chapters are mostly based on WWF's Human-Wildlife Conflict Manual (2005) and Elisa Distefano's (2003) analysis of management strategies from a collection of case studies of HWC worldwide.

Distefano (2003) divides HWC management practises roughly to mitigative and preventive strategies. Mitigative strategies attempt to reduce the level of impact and lessen the problem, whereas preventive strategies aim at preventing the conflict from occurring in the first place and try to address its root causes. The division can also be made between short and long-term practises. In either case the distinction between a strategy being mitigative or preventive, or short or long-term, is not always clear, as is for example the case with *barriers*: they can be preventive when the barrier successfully separates wildlife from human areas, but often they merely complicate the access while animals learn new ways to pass the obstacle. Barriers can be either artificial or natural. They are often used to enclose protected areas. Another solution is to construct barriers close to human settlements to protect crop fields and livestock. Fencing homestead areas instead of larger reserves is less expensive and allows greater wildlife dispersal. The downside of the physical barriers is that are not necessarily a cost-effective management practice as barriers often require additional expenses for their maintenance besides of possibly high construction costs. Moreover, they cannot normally ensure complete protection alone. In addition to fencing, *guarding* is a widely used preventive strategy. It is often vital for farmers to guard their fields and invent tactics to alert them and to scare away the animals.

Land use planning and *relocation* of settlements and farm lands can be counted as long-term preventive measures. Relocation should always be voluntary and include substantial benefits such as better access to resources and socio-economic opportunities (Distefano 2003: 15−18). Shifting settlements from a place to another is almost inevitably expensive and in most cases infeasible. Land use planning is normally an easier and more practicable strategy. The aim is to create a space in which the human activities would not overlap significantly with wildlife habitat, a space in which both sides can live concurrently without coming into contact that could lead to conflict. The planning can concern for example the location and size of cultivations and settlement, changing cropping regimes, and securing separate water points for wildlife (WWF 2005: 15).

In some cases, the trouble causing animals are certain individuals who repeatedly strive to human areas while most of the members of that specie stay in the wilderness. In these situations, *relocating the problematic animals* to another area can mitigate or even solve the local conflict with wildlife. Translocation can be practical and acceptable in cases where there is suitable habitat available elsewhere with territorial vacancies. It is anyhow quite challenging and expensive, requires professional personnel, and animals often return to their original territory if they are not moved sufficiently far away. There is also a risk that translocation shifts the conflict to the new area. *Culling* the problematic animals would be another fairly simple solution but lethal control can also lead to problems if it is not well regulated, and especially with endangered species it is rarely acceptable. (WWF 2005: 17; Distefano 2003: 20−21)

Some of the mitigation strategies aim to ease the conflict by increasing public tolerance towards wildlife by incentives and compensations. These programs can also be essential in situations where wildlife induced losses seriously hamper people's subsistence. This economic injustice at HWC zones has led to calls for *compensation programmes*. Compensations are used to pay for crop and livestock losses, property damage, and human injuries and deaths. Compensation can be either a monetary payment or some alternative settlement, for example licenses to exploit natural resources. It can be argued that lack of compensations would be unjust since it is a limited group of people who bear the costs of conservation while the others enjoy the benefits of it. Furthermore, mitigation efforts of local farmers are restricted by conservation policy and thus people deserve to be compensated as the policy has negative implications on them. The rationale of conservation programmes can be easily justified but the practise has received a lot of critique. The schemes are heavy to administer, and conservation authorities often lack the revenues to finance these programs without external support, especially in developing

countries. This has led to inefficiency and low rate of compensations (WWF 2005: 18; Distefano 2003: 18−19). Furthermore, the compensation schemes are complicated to implement and exposed to fraught and corruption. Verifying damages against fraudulent claims is a challenging and time-consuming process. There is also a risk of a 'moral hazard': a situation in which people lose the incentive to protect their crops or livestock because they are equally compensated for losses. Compensation programmes can even run counter to conservation objectives by providing incentive to expand agriculture and promote in-migration by people seeking access to compensation (Mackenzie & Ahabyona 2012).

Insurance programme can be considered as an alternative for compensation scheme. In these programmes individuals or communities pay premiums for insurance against crop damage, loss of livestock or personal injury or death. The clear advantage of insurance programmes is that the local governing bodies avoid the weighty financial expenses related to administering compensation schemes (WWF 2005: 18; Distefano 2003: 20). Though maybe more functional if well organized, the insurance programme can be criticised for its unfairness: the farmers that are restricted by the conservation policy must bear the cost of premiums while again others get to enjoy the possible benefits of conservation for free.

When conservation requires certain changes in local people's activities (for example in land or resource use) *incentive programmes* might be useful. These programmes are based on subsidies that are paid to offset the cost of conservation. As an exchange for subsidies people are required to adopt conservation-friendly practices (Distefano 2003: 20). For example, farmers and pastoralist can stop cultivations and grazing in lands that are then left for wildlife, or to change to different livelihood activities that do not compete of resources with other species.

Like pointed out earlier, human-wildlife conflict resolution needs a combination of both short-term mitigation tools and long-term preventative strategies. Single management options are rarely if never enough. On top of the general management strategies introduced here, one important approach to ameliorate HWC is to build and strengthen the local management institutions as observed by Naughton-Treves and Treves (2005). Without well-functioning institutions it is hard to manage HWC even if the used strategies and tools were otherwise adequate. The local people who are involved in the conflict can also have an essential role in its resolution. They often possess important knowledge of the local conditions and their actions can directly influence the situation between humans and wildlife. Thus, the needs and

expectations of the entire affected community must be taken into account when developing solutions to human-wildlife conflicts (WWF 2005: 8).

2.2 Human-elephant conflicts

Human-elephant conflict unsurprisingly shares a similar definition as HWC but focused on elephants. Parker et al. (2007: 11) define it as "any human-elephant interaction which results in negative effects on human social, economic or cultural life, on elephant conservation or on the environment". Elephants have gained plenty of attention in HWC research due to the severity of the conflicts and the globally valued status of elephants. Following the fragmentation and the ensuing interspersion of human habitation and infrastructure, cultivation, and natural habitats, elephants are compelled to share territories with humans. When both parties utilize same land areas and resources the interaction tends to turn into competition and conflict. HEC is widespread throughout the elephant range in Asia and Africa where it poses significant problems to some of the local communities (Perera 2009; Parker et al. 2007).

There are different location specific motives for elephants to enter human areas. The underlying reasons are generally related to the global long-term development trend of human settlements, resource extraction and cultivations spreading deeper into natural wildlife habitat. This development has led to a situation in which human and elephant territories increasingly overlap with each other. The response for the challenge of co-existence has typically been spatial separation. Landscapes of human-elephant cohabitation are politically split into wildlife reserves and spaces for people (Barua 2014). This separation is often problematic especially in the areas where the confined elephant habitat is not sufficient to uphold the population. In such locations the borders are contested by elephants that transgress to human areas to fulfil their nutritional needs. They might also trespass to villages and fields because those have been founded on traditional migratory paths of elephants' or in areas that contain important nutritional sources like saltlicks. Conflict is frequent in places where agriculture takes place directly adjacent to protected areas. Even if the PA would serve sufficient food and water, elephants might prefer the crops grown by humans because they are more palatable, more nutritious and have lower secondary defences than wild browse plants (Palita & Purohit 2008: 91). The easy availability of food in dense gardens and cultivations can be another pull factor. Elephants can fulfil their daily nutritional need faster and easier at cultivations than in nature. Research has shown that elephants can also become habituated to crop raiding after learning its

benefits so to say. It can become a routine for some individuals. (Barua 2014). Hence crop raiding is not always, though often, a necessity for elephants' survival. It can also be a routine learned through the coexistence with humans. Not all elephants raid crops however. Crop raiding is more typical to male elephants and it can be limited to certain individuals only. Female elephants, especially if accompanied with offspring, raid crops much less frequently (e.g. Ekanayaka et al. 2011).

2.2.1 Impact of HECs

Crop losses for elephants can seriously hinder the subsistence of farmers. Compared to other wildlife, one special characteristic with elephants is that the havoc they cause is usually sporadic but possibly disastrous by magnitude. Elephants consume around 150 – 200 kilograms of vegetation each day. Due to the high consumption a single elephant can destroy tens of ares of crops in a matter of hours. A small herd can easily devastate farmer's complete harvest overnight (Parker et al. 2007; Santiapillai et al. 2010). Because of elephants' catholic diet very few plants among those cultivated by man are immune to crop raiding. For example, Nath et al. (2013) observed that elephants damaged 26 different species of plants in their study area in India. Similarly, in Sri Lanka Ekanayaka et al. (2011) counted 25 different crops damaged by elephants. Most of these were eaten but elephants also cause damage by trampling plants that they do not consume. There is typically seasonal variation in crop raiding though in some places it might occur around the year. The raiding reaches its peak usually when the crops are mature. Dry seasons can be another peak time as the natural food and water sources diminish (Ekanayaka et al. 2011).

Crop raiding and elephant encounters happen typically at the borders of protected areas. Characteristically only parts of the villages are affected as elephants rarely ingress further than into the parts that are closest to forest boundaries. The fields and houses at the boundary work like a buffer where the elephants are already spotted and chased away. Consequently, the burden of the conflict is unevenly distributed also in village level, with the outermost families being typically the most disadvantaged (Nath et al. 2013: 14; Mackenzie & Ahabyona 2012; Naughton-Treves & Treves 2005: 270). It is mostly the rural poor that bear the cost of HECs. The people who have the least resources to protect their fields, for example with costly electric fences, are the ones who tend to suffer most losses. These families face compounding burden as they cannot protect their fields from crop raiding due to lack of wealth which is further

deteriorating from crop losses (Naughton-Treves & Treves 2005: 257). For the families that are economically and nutritionally vulnerable a loss of crops can have serious impact on their income and food consumption (Mackenzie et al. 2012: 77; Palita & Purohit 2008: 91).

Elephants can also damage infrastructure like water tanks. When entering people's fields and gardens they break fences and other obstacles on their way. Elephants damage property also by breaking into houses and storages to access the food inside. Besides, there is a high risk of injury in human-elephant encounters. These can even lead to casualties, human and elephant alike. For example, in India HEC results each year in over 200 elephant and about 300 human deaths; and in Sri Lanka, with significantly smaller human population, on average 150 elephants and 50−70 humans die yearly because of the conflict (Perera 2009: 43−45). (Debata et al. 2013; Nath et al. 2013)

Like typical for many HWCs, HEC can also have significant indirect costs. The threat of crop raiding needs to be countered with guarding. Guarding is needed especially during night when most of the incursions happen. People who are regularly needed to guard the fields can suffer from lack of sleep. This can negatively affect their general productivity and health. Guarding leads also to opportunity costs: men and women cannot engage in other income generating activities because guarding takes their time. The direct physical threat that elephants pose can limit people's access to some areas and resources. It is always risky to enter forest areas habituated by elephants. The presence of elephants can also cause stress because of the direct danger that they pose on people's health, and because of their ability to cause serious losses in a single raid. (Parker et al. 2007: 13)

2.2.2 HEC mitigation strategies

There are numerous ways of how HEC has been mitigated. The methods range from simple traditional methods used by villagers to expensive modern strategies run by state agencies. The HWC mitigation strategies were briefly described in the earlier chapter. Next, I will have a closer look to the ways how these measures have been used more specifically with elephants. Earlier studies have shown the importance or certain methods, the failure of others, and the potential of some that have briefly been experimented.

Rural communities have invented various crop protection tactics over time. Traditional deterrents are usually composed of low-tech materials that are available locally. Farmers use a

range of noisemakers such as drums and yelling, throw rocks and firecrackers, light fires and make unpleasant smokes by burning rubber for example. Similar tactics are widely used with local variations. Barriers are often constructed around farms and homesteads to deter elephants. These can vary from thorn branches to logs and to simple ropes hanging elements that are either meant to frighten the elephants or warn the farmers of intruders. None of these barriers can stop elephants altogether but they can have psychological deterrent effect if the elephants are not familiar with them. A common problem for all traditional deterrents is that they tend to become useless over time. When just few methods are used with little variation elephants may habituate to them and eventually completely ignore them. (Parker et al. 2007: 30)

Crop losses can be reduced by active guarding of the fields. There are number of ways to improve vigilance and consequently enhance crop protection. Watch-towers are safe places to observe approaching elephants. Powerful torches can be used to locate elephants before they reach the fields. Creating buffer zones by clearing vegetation around the fields can improve the chances of spotting elephants before they get close. Elephants can also be afraid to enter open areas where there is no cover from vegetation. Alarm systems like metal or glass objects hanging from string fences are also useful for alerting farmers of the presence of elephants or other intruders. Well working system can relieve the burden of guarding as the person does not need to stay vigilant the whole night. (Perera 2009: 47; Parker et al. 2007: 37)

A range of conventional deterrents have been used by the wildlife managers across African and Asian elephant ranges. Guns are used at times to chase elephants away. Parker et al. (2007: 30) refer to disturbance shooting as firing of gunshots over the crop-raiding elephants to scare them. This is usually carried out by wildlife authorities that arrive at the raiding location when alerted. The method is often constrained by transport and logistical problems that cause slow response times. When the officials arrive to the scene the crop damage might have already happened. Studies have shown that elephants can get habituated even to the sound of gunshots if exposed to them often. (Parker et al. 2007: 30)

The failure of traditional deterrence methods in reducing crop-raiding has led to increasing investment in electric fencing. As this has become a widely favoured mitigation strategy, also in Sri Lanka, I will cover electric fencing a bit more thoroughly here. The electrified elephant fences deliver a short high-voltage, low current electric shock when touched. Power is typically generated by solar panels and stored in accumulators at the fence. The fences have been used to protect small farms, enclose entire wildlife reserves, or to deflect animals away from specific

areas. It is quite clear that electric fences can mitigate HEC when well implemented and maintained but they cannot provide guaranteed protection. Elephants are notorious for finding weak spots in fences and for learning new ways to break and bypass them. According to Parker et al. (2007: 31), anecdotal evidence suggest that elephants can overcome even the most sophisticated barriers over time. The problem with electric fencing is also that while protecting one area it may shift the conflict to other areas (Gunaratne & Premarathne 2006: 4). The high setup and maintenance costs of electric fences can also make it an impractical solution in poorer regions. For the fence to stay functional over time it requires sustainable funding.

Gunaratne's and Premarathne's (2006) study of electric fences in HEC mitigation in Sri Lanka revealed a range of factors that influence the success of electric fencing. These factors can be divided in two broad categories: technical factors (related to fence design and administration) and socio-economic factors (related to the stakeholders in the conflict). Electric fences are typically built to cover either an elephant habitat or alternatively human settlements. The areas can be covered completely or partially. Gaps can be left so that elephants can move in search of food and water between the seasons, or to allow people to enter the forest areas. Even in situation in which complete coverage would be needed, the fences tend to cover only the areas that are the most affected by HEC due to budgetarily limitations. Incomplete coverage can be problematic as elephants learn to know the open spots for accessing the human areas. In the areas that are completely covered HEC incidents happen more rarely, mainly just as a result of fence breakages (Gunaratne & Premarathne 2006: 35).

Ignoring geographical and other variations in the areal features can also lead to bad implementation. For example, Gunaratne and Premarathne (2006: 35) discovered in some of their study areas that a fence ended at a stream through which the elephants could enter, or that the fence was placed along a side of mountain where it was exposed to frequent damage. As the lack of food and water are key factors that induce elephant incursions, the availability of these resources needs consideration too. Electric fences should not prevent the elephants from accessing adequate food and water or otherwise the fences will continue to be damaged by elephants. Another factor that needs to be considered with the placement of the fences is elephant's migratory behaviour. Electric fencing is successful only if traditional migration corridors are maintained (Gunaratne & Premarathne 2006: 35 – 36).

The fences must be designed so that they cannot be easily broken. In Gunaratne's and Premarathne's (2006) research the poor design of fences was considered to be the key reason

for their ineffectiveness in some areas. The poles need to be strong and in deep enough depth so that they cannot be tipped over. There needs to be also enough power supplying units to keep the current strong.

Social acceptance can also influence the success of electric fencing. The support for fences is not always guaranteed, largely because it separates the village from the forest. For many rural people the linkages to the forest can be important, not least for their subsistence. Forests can provide many important resources and thus the physical separation of the people from the forest that the electric fence creates can be contested. The lack of support for the fence hinders its maintenance and the fence may even end up getting damaged. Local people who are highly dependent on their forest resource might continue trespassing and further encroach the forest area which can in turn increase the number of elephant incursions. The community support for the fence is especially important if the fence is to be maintained by the community. (Gunaratne & Premarathne 2006: 36 – 38).

One of the main problems with electric fences is that they require a lot of maintenance. Elephants can easily brake them if their condition deteriorates or if the voltage falls. Typical reasons for the low voltage are growing vegetation that breaks the voltage when touching the wires, and simply badly connected wires because of poor repair (Evans & Adams: 2016: 226). Financial limitations are often the reason for poor maintenance. In poor areas people are usually not willing to contribute to the maintenance costs. Instead this is thought to be the responsibility of government agencies. Communities can still be partly involved in the maintenance work. In these cases, it is important that the community-based organizations are well functioning. It should be guaranteed that the people that take part in the maintenance are well trained as the lack of technical know-how can lead to poor maintenance (Gunaratne & Premarathne 2006: 39 – 40).

Ownership can play also an important role for the success of electric fencing. If a government agency has the sole responsibility of constructing and maintaining the fence, problems might occur if their funding does not stay continuous. Parker et al. (2007) had found that these agencies rarely have the funding year after year and inevitably the fence deteriorates. In some situations it might be better if the local community builds the fence and maintains it. When the people who are directly affected by the issue have a stake in its success the fence may be better taken care of. However, according to Parker et al. (2007: 31) many community fences have

failed because of local maladministration and thus the emphasis is now upon fences that are individually owned.

Although electric fencing is now highly advocated it cannot stand as a conclusive mitigation measure on its own. Other short-term solutions can still be helpful in preventing crop raiding, and other long-term solutions are anyhow needed. For example, according to Gunaratne and Premarathne (2006: 1) there is a "need for an integrated approach to solve HEC problem with comprehensive land use planning and habitat enrichment where electric fencing is an important component.".

Trenches have been used the similar way as electric fences, dug along protected area boundaries or farmlands. They must be deep and wide to ensure that elephants cannot cross them. Sharp sticks or stones may be used to further deter elephants from crossing. The problem with trenches is that elephants can learn how to fill them by kicking in the sides, thereby enabling them to cross. They also need intensive maintenance especially in rainy seasons when erosion is high. Either intensive labour or mechanized digging equipment is required to make the trenches. This can be a challenge in situations with limited resources.

Barriers have also been made of vegetation. Often called live fences, thorny bushes or trees (e.g. cactus, agave) that are uneasy to pass can be planted in rows to prevent elephants from entering the other side. However, there is no univocal evidence of the effectiveness of live fences. Implementing a natural barrier like this takes time, and other measures like electric fences might be needed to protect the plants until they mature. (Perera 2009: 47; Parker et al. 2007: 33)

HEC has at times been mitigated by removal of problem animals. This can be done either by translocation or lethal control. Culling is typically considered as the last resort. It has been carried out in parts of Africa to control overpopulation and to prevent damages. In most Asian countries killing of elephants is ethically and culturally unacceptable. Translocation of problematic elephants is a more humane alternative for this. However, translocation is expensive and requires specialist equipment and skills. Translocated elephants have also returned to the original sites and might have caused problems in their new location. (Perera 2009: 48; Parker et al. 2007: 31−32)

People have also invented more experimental deterrent methods. These are typically either various smells, tastes or noise that are aimed to repel elephants. Acoustic deterrents use either shock value from loud bangs or such, or some more specific noises that are known to scare

elephants. Olfactory deterrents are usually something that smells or tastes unpleasant. For example, capsicum repellents have been used against elephants. The fruits of Capsicum plants, e.g. chillies, contain capsaicin which gives the burning sensations that most mammals find unpleasant. This has been put in sprays that has been tested to repel crop-raiding elephants. Chillies are also burned together with dung (chilli bricks) to produce a strong-smelling cloud of chilli smoke that repels elephants. These repellents have been found useful in parts of Africa (Perera 2009: 47−48; Parker et al. 2007: 34, 38). Bee-keeping is another example of experimental measures. Elephants are known to avoid bees and typically if confronted by bees they retreat. Studies in Africa have shown that even playback of bee sound can make elephants go away, although if conditioned to this sound regularly they would get habituated to it (King 2013). An actual presence of bees can be considered more effective. Beehives can be used as fence like natural deterrence, placed around crop fields or homesteads. This method has been proved effective in parts of Africa, where the African honey bees' (Apis millifera scutellate) aggressive behaviour frightens African elephants (Loxodonta Africana). However, it is unclear if the same method would be functional in Asia where the tamer Asian honey bees (Apis cerana indica) do not protect their hives as aggressively. A study conducted in Sri Lanka by King et al. (2018) found mixed responses of the Asian elephant to the sounds of Asian honey bees. Based on this study's findings it is unclear if bee-keeping can be used as a working deterrent in the Asian elephant range. (Evans & Adams 2016; Shri et al. 2013).

Longer-term HEC mitigation measures include land use planning. It aims to separate agricultural activities and elephants by identifying separate areas for farming and wildlife, limiting agriculture or changing crop pattern close to protected areas, or through creation of buffer zones. Buffer zones can be like the earlier mentioned open areas where elephants are easy to spot. The areas that are lacking protective vegetation might be avoided by elephants. Certain plants can also form a buffer. For example, unpalatable crops like chilli, tea, tobacco or citrus can be grown closest to forest boundaries and keep the crops that attract elephants further away in areas that are not as easily accessible. (Perera 2009: 47; Parker et al. 2007: 39)

Rehabilitating natural habitats can have positive long-term impact in HEC mitigation. In situations where suitable land is available, creating more reserves for elephants can be one solution. Quite often though the situation is more of the opposite, conflict having its roots in the paucity of land. In these situations, increasing food and water resources in existing wildlife areas can decrease crop raiding and other incursions by elephants. It is also important to plan

wildlife corridors to the elephants' migrations routes so that habitats are functionally linked together. (Palita & Purohit 2008: 86)

Compensation schemes are also implemented in HEC zones, but these schemes have largely been viewed as failure. According to International Union for Conservation of Nature's (IUCN's) African Elephant Specialist Group (AfESG) (2002) compensation schemes for elephant damage suffer from several deficiencies. Most of the reviewed schemes suffered of the same issues that were mentioned in the chapter 2.1.3. AfESG list the issues as following:

- Compensation is unable to decrease the level of the problem (because the cause of the problem is not being addressed).
- Compensation reduces the incentive for self-defence by farmers (and therefore could even exacerbate the scale of the problem).
- Compensation cannot address the unquantifiable social 'opportunity costs' borne by people who are affected by the threat of problem elephants.
- Compensation is cumbersome, expensive and slow to administer, (because of the need to train assessors, cover large areas, have stringent financial controls etc) and once embarked upon, potentially has no endpoint.
- Compensation is open to considerable abuse or blatant corruption (e.g. through: bogus claims; inflated claims; deliberate cultivation in places where crops are likely to be damaged).
- There are usually never sufficient funds to cover all compensation claims.
- Payment of compensation to only some victims may cause disputes or social problems.
- Where compensation schemes need to be promulgated in law, their ability to keep pace with changing economic circumstances or changes in social policy are hopelessly slowed down.

According to Bandara & Tisdell (2003) where compensations have been paid they are often far from compensating the actual losses and neither do they encourage locals to conserve elephants. Because of these deficiencies some authors have recommended that funds should be directed in crop raiding defences instead of compensation programs (e.g. Mackenzie & Ahabyona 2012; Thouless & Sakwa 1995; Warren et al. 2007). Others have still emphasized the need for compensations to countervail the economic injustice that some farmers face because of crop raiding (Naughton-Treves 1998; Tchamba 1996).

Based on my literature review, insurance programs have taken place more rarely. They could offer a potential alternative to compensation schemes, though from equality point of view placing the cost of premiums on local farmers can be questionable. If a fair share of the programs expenses is covered by revenues from conservation or otherwise externally funded, the insurance scheme can be more justifiable. Parker et al. (2007: 40) had reviewed local insurance schemes in Namibia. These had proved potential. In the schemes payments are made only to registered conservancy members according to the conditions agreed by all the part takers. There is less opportunity for corruption because of the tighter control than in conventional compensation schemes. Another advantage is that all the conservancy members pay into the system and therefore have a stake in it.

Besides these mostly technical approaches to HEC mitigation, it is also important to consider the local dynamics that drive people and elephants into conflict in the first place. For example, if local policies support agricultural expansion it is not surprising if the conflict escalates. Maybe some illegal action in protected areas drives elephants to villages? Could it be that badly planned development projects have changed elephants' migration routes, or maybe cultural change has deteriorated the valuation of elephants? These are just examples or various underlying factors that can have less obvious impact on human-elephant relations.

3. HEC in Sri Lanka

3.1. Background of the elephant issues in Sri Lanka

There is a long history of human and elephant co-existence in Sri Lanka. This co-existence has turned increasingly problematic over time with human population growth and development leading to an increased competition of space and resources by humans and wildlife. For the past decades and years, the trend has been towards ever increasing conflict. Both elephants and the rural people are suffering as a result. Besides being the main threat to the survival of the endangered Sri Lankan elephants, HEC causes damages to people's crops and other property, and even losses of life every year. According to UNDP (2012: 4) between 1991 and 2010 1138 people were killed by elephants and 2844 elephants were killed by farmers. In three years from 2004 to 2007 a total of 3103 homes were destroyed by elephants. Like these numbers suggest, finding appropriate solutions to deal with the HEC is important both for the conservation of elephants and for the wellbeing of Sri Lankan farmers. I will next present the general long-term

changes that have led to the current situation in Sri Lanka. After that I will shortly present the national policy for the conservation and management of wild elephants which will be reflected when assessing the results from this study.

The survival of the endangered Sri Lankan elephants in such significant numbers this far can be attributed in parts to the cultural importance of elephants and the consequent tolerance of them. Elephants have special religious significance in both Buddhism and Hinduism, that constitute two of the biggest religions in Sri Lanka (70.2% being Buddhist and 12.6% Hindu) (Department of Census and Statistics 2012: 160; Santiapillai et al. 2010: 21). However, this traditional tolerance has been diminishing, like the number of elephants, as HEC has intensified throughout the past decades. Elephants have occupied the dry-zone of Sri Lanka for centuries. The area used to be extensively forested and sparsely populated by humans until few decades ago when the large scale national Mahaweli development programme was initiated. The accelerated Mahaweli hydro-project that started in 1978 dammed and diverted the longest river in Sri Lanka, Mahaweli, to irrigate the dry zone. Under this project, large areas of forests were cleared and brought under irrigated agriculture, cultivated by settlers who migrated from other parts of the country under a trans-migration and settlement program. In less than a decade, extensive areas of previous elephant habitat were transformed into a human dominated landscape that has ever since been characterized by countless man-made irrigation reservoirs or tanks. The elephants that were now ranging in agricultural lands were translocated into protected areas by elephant drives and transport. This however could not eliminate the elephants from the developed areas, but instead the continuous presence of them has led to conflicts with humans. (Fernando et al. 2005: 2466 – 2467)

A major driving force behind the expansion of agriculture and consequent waning of forestland has been the doubling of the total population from the beginning of 1960s. In these past decades the population leaped from 10 million to over 21 million. Most of the growth has taken place in the rural parts of the country (109.2 percent increase in rural population from 1960) Due to the rapid expansion of population the available land area is getting increasingly scarce. In Sri Lanka the population density is way above the world average making it one of the most densely populated countries in the world (World Bank Open Data 2018).

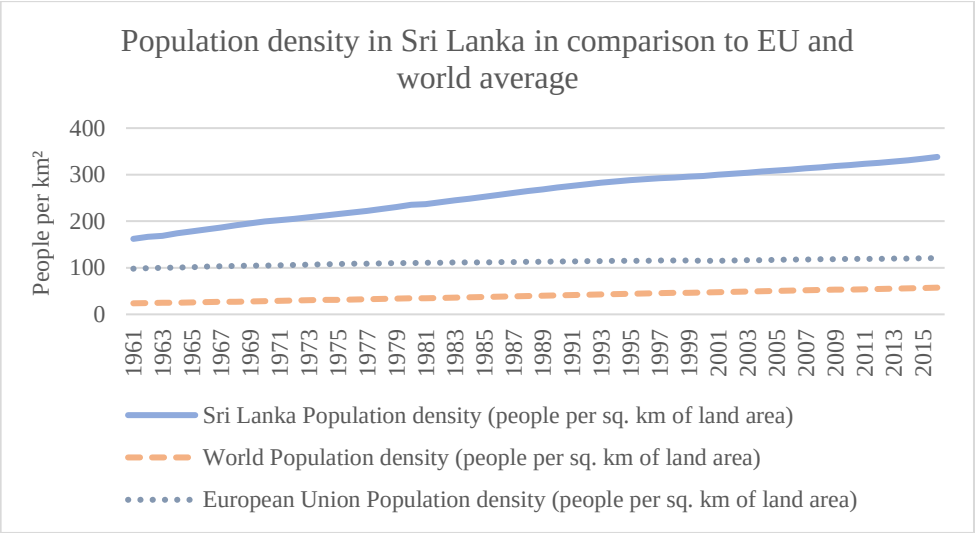

Figure 4. Population density in Sri Lanka compared to EU's and world average (World Bank Open Data 2018).

A little over 80 percent of Sri Lankans live in rural areas (81.6 percent in 2016). Although the share of total workforce engaging in agriculture has dropped from 43.2 percent in 2000 to 27.4 percent in 2017, the mostly rural population growth places continuous pressure on the remaining natural habitats (Employment in agriculture 2017). In the past six decades the forest cover has fallen from around 50 percent to 33 percent of the total land area (or to 22 percent according to Gunaratne & Premarathne 2006: 2), with the biggest changes taking place before 1990s. According to Fernando et al. (2011: 97), habitat loss due to developmental activities continues to occur at a fast pace especially with the drive for post war development. Large scale irrigation schemes are still being designed and implemented. Turning large extends of natural habitat in to the use of commercial agriculture is promoted as part of the development drive. Medium scale development that is based on building small rain fed reservoirs funded by government and non-government organizations also continues apace as does fine scale but widespread encroachment of state land for farmsteads by individuals.

The loss of habitat and land fragmentation through conversion to settlements and permanent cultivations have been identified as the main reasons for HEC in Sri Lanka (Fernando et al. 2011; Santiapillai et al. 2010; Gunaratne & Premarathne 2006). Despite the earlier efforts to confine elephants in protected areas, the actual habitat of the 2500 – 4000 Sri Lankan elephants (Choudhury et al. 2008: 7) extends far beyond the system of national parks and nature reserves into areas that are often shared with humans. According to the Department of Wildlife Conservation (2006) about 70 percent of the elephant range lies outside of the protected areas. These areas are important for the viability of elephants as many of the PAs already hold

population sizes that are at the maximum for their long-term carrying capacity (Fernando et al. 2005: 2478). In the absence of substantial habitant management and enrichment programmes to increase the carrying capacity of protected areas, confining elephants in parks is not a feasible option.

The continuous human encroachment into the natural habitat together with the decreasing capacity of the forest reserves has forced elephants to ingress into human use areas where crops act as dietary substitute. Roaming elephants raid farms and gardens, damage houses and other property, and in some instances attack people injuring or even killing them. According to Fernando et al. (2011: 96) elephants are becoming more accustomed to this situation. They tolerate higher levels of conflict and raid crops even more frequently and aggressively. Traditional strategies that have been used to deter and chase off elephants, such as shouting, lighting firecrackers and making other loud noises, are no longer effective in many HEC areas (Gunaratne & Premarathne 2006: 2). The ineffectiveness of the traditional methods together with the infeasibility of translocating elephants in PAs have led to an increasing adoption of electric fencing (Gunaratne & Premarathne 2006). This has been widely considered the most effective measure in HEC mitigation. A substantial number of electric fences have been built in Sri Lanka and more are being installed as part of the Department of Wildlife Conservation's policy.

3.2. The national policy for the conservation and management of wild elephants in Sri Lanka

The Department of Wildlife Conservation recognizes that HEC is the major cause of elephant mortality and a main threat to the survival of elephants outside the protected areas. Therefore, the present national policy for elephant conservation was introduced in 2006 to ensure the long-term survival of elephants in the wild through the mitigation of human-elephant conflict. Besides being a serious conservation issue the policy statement acknowledges that the conflict has grave implications on people's wellbeing and therefore suitable conservation policies should also consider this dimension. The national policy for elephant conservation states that "Elephant conservation in Sri Lanka should not simply be a matter of protection the charismatic species; it should also be about the wellbeing and survival of the people who share their land with elephants." (DWC 2006).

The national policy for the conservation and management of wild elephants in Sri Lanka (2006) contains six statements:

1. To ensure the long-term survival of the elephant in the wild in Sri Lanka.
2. To mitigate the human-elephant conflict.
3. To derive socio-economic benefits from conserving the elephant.
4. To defray the costs imposed by the human-elephant conflict on communities affected by it.
5. To adopt regulatory mechanisms for the removal of elephant from the wild for management reasons.
6. To promote scientific research as the basis for elephant conservation and management in the problem facing the DWC in Sri Lanka.

The policy recognizes that successful conservation of elephants requires large areas, areas way bigger than the current system of protected areas contain. The scarcity of land in the densely populated country also means that there is no easy possibility to extend the network of protected areas. Thus, the policy states that the lands other than PAs that can support elephants are to be integrated into Elephant Conservation Areas (ECAs). These areas comprise the PAs of DWC, forest areas maintained by the Forest Department (FD), and the Managed Elephant Ranges (MERs) that are lands which do not belong to the ownership of these agencies but where elephants will be conserved on-site. All detrimental land use practices and encroachment that contribute to HEC are prohibited in MERs. The areas are also to be managed so that their carrying capacity stays as strong as possible.

The plan to mitigate HEC consists of three parts: reducing the damage caused by elephants, reducing the loss of elephants, and minimizing potential for conflict. The policy statement rightly points out that single solutions are not effective in HEC mitigation. Multi-pronged strategies are needed instead. There are a range of strategies that need further testing to assess their suitability. For example, the statement mentions deployment of early warning systems, establishment of live fences, use of acoustic deterrents and other elephant repellents, and cultivation of unpalatable crops along the perimeters. It is emphasized that the methods should be tested in various locations as individual methods can be effective under some circumstances but not in others and thus cannot easily be recommended as general solutions. The policy paper promotes especially the early warning systems but also the use of traditional crop protection methods as far as they are effective.

Elephant-proof barriers are introduced as more generally applicable solutions. According to the policy statement, passive barriers like trenches and ditches have shown limited success whereas electric fencing has proven to be the most successful method in HEC mitigation. However, it is acknowledged that electric fences face the challenge of high cost of construction and management. Thus, it might be difficult to effectively introduce and maintain the fences in all human-elephant conflict sites. The statement suggests that community participation in the maintenance would cut down the costs, but this would still require a full-time officer to be employed to coordinate and supervise the work.

In cases of habitual crop raiders or aggressive individuals the policy recommends relocating these elephants to ECAs where they are less likely to cause trouble. It makes an important remark in that translocation should always be considered thoroughly beforehand as it can result in social disruption in elephants' lives and translocate the problem to the new place. It is also admitted that central to the translocation of a problematic animal is to correctly identify it, and this can be very challenging as most of the crop raiding happens after dusk. In some challenging situations in which remote human settlements are situated in areas with large numbers of elephants, relocating the people by offering shelter and alternative livelihoods elsewhere can also be an option.

Besides the more technical approaches the policy also points out a need for educational awareness programs and different organizational arrangements. It supports the establishment of village committees that would carry out elephant conservation actions such as monitoring elephants' movement and chasing them back to forests when needed. DWC should also have Elephant Control Units (ECUs) in badly affected areas, where their task would be to quickly react to elephant incursions.

The importance of socio-economic factors for the elephant conservation is also acknowledged by the policy. Besides cultural appreciation people need economic incentives to encourage them in conservation. If people regard elephants only as problematic pests, this will surely have detrimental impact on conservation. Benefits are to be derived from community-based ecotourism, and from small-scale cottage industries based on elephants such as production of biogas or manufacture of paper and mosquito repellents from elephant dung. The policy also states that the costs of HEC imposed on farmers should be defrayed through compensation and insurance schemes. As most farmers cannot afford the premium of insurances part of these schemes were to be funded by public support. The policy statement from 2006 says that private

insurance agencies should be induced to take on these schemes. It is unclear if these insurances are currently offered in Sri Lanka. The compensation scheme had already existed before the drafting of 2006 policy, but the plan stated that these needed to be strengthened to enable prompt disbursement of funds and to foster improved relations with the Department of Wildlife Conservation.

The compensation scheme is not explained in more detail in the DWC's policy, and I was not able to get a documentation of this which would have been directly from DWC. Therefore, I will here present the scheme based on other sources. According to Fernando et al. (2011: 99) compensations are currently paid for death, injury and property damage. In recent years the compensation for death has been 100 000 Sri Lankan Rupees (equating approximately 520 euros with the conversion rate in March 2018). For injuries and property damage the compensation is less and dependent on the severity of each case. Compensations for crop losses have been tried too but the scheme has been unsuccessful in compensating these losses. Apparently the level of compensations has been raised at least as to deaths. Recent news suggest that the compensation had already been 200 000 rupees and has now been raised to 500 000 rupees (e.g. Compensation paid for wild elephant attacks increased 2017; Sri Lanka to hike damages for elephant attacks 2017).

Overall the policy from 2006 recognizes well the general challenges in HEC mitigation that have been brought up in the literature of the field: the infeasibility to confine elephants in protected areas only, the need for a combination of mitigation strategies, circumstantial and other limitations of these strategies, and the importance of socio-economic factors for conservation and the interlinked human wellbeing. However, for example Fernando et al. (2011: 94) pointed out that despite of issuing the policy it had not yet been effectively implemented.

4. Study objectives

We started this study knowing that the area is facing issues with elephants, but we wanted to learn better how severely HEC affects the lives of the villagers, what kinds of factors are causing this issue, which kinds of mitigation strategies have been used to tackle the problems, and how well the conflict is currently managed. One key thing in this study was also to consider the areal

differences. Are some parts of the study area possibly worse affected, or do some villages encounter elephants only rarely? The study could not address all the complex dimensions of the elephant issue in detail, but instead it aims to assess the situation in broad general level.

First objective was to identify and describe HEC events in Bogahapalassa. The main questions here are:

- Where and when the conflict takes place?
- How HEC impacts the lives of local villagers?

Bogahapalassa is a relatively big and heterogenous area with dozens of villages around it. Especially the mountainous north and the flatter south formulate geographically distinct parts. Because of this and the location specific nature of HWCs the study draws attention to areal differences in the occurrence of the conflict. Almost all the villages around Bogahapalassa were visited to identify possible 'hotspot' areas or villages where there might be no issues at all. Furthermore, as encountering elephants can be seasonal, following the migratory trends of elephants or maturing of crops, temporal variation is also considered. If considerable differences are found the mitigation efforts could be adjusted accordingly. The impact of the conflict on local lives is studied by surveying both the direct and indirect costs. In this study it is not possible and neither intended to count exact numbers for crop losses or other damage. Instead the interest is in the type of costs and in the estimated severity of them. The study aims to understand which livelihoods are affected and how, and what other aspects of the local life are impacted by the elephant issue.

Considerable part of the study centres around HEC mitigation. It strives to answer the following questions:

- What are the mitigation strategies used by farmers and government agencies?
- How have these mitigation strategies worked?

By collecting experiences of different mitigation methods, I thrive to recognise which measures fail to work and what are their deficiencies, and on the other hand which measures show potential in mitigating the conflict.

Part of the study deals with people's perceptions of the conflict's causes and solutions. Here the question is:

- How the villagers and government officials perceive the causes and solutions for HEC?

Surveying these perceptions serves two functions. First, the intent is to gather information from multiple sources: from local farmers to government officials and other key informants. I acknowledge that explaining the conflict's causes comprehensively would require more thorough research at each site, something which was not possible in this study. But the perceptions of the interviewed villagers and officials can capture the important main causes or even some surprising location specific characteristics and point out directions for further research. Also, the opinions and ideas raised by these participants are not treated as solutions per se, but reoccurring themes can point out important local aspects worth of considering. Secondly, the study is interested to find out if there is consensus or dispute between the views of the villagers and officials. Shared consensus of the reasons and needed actions can ease the conduct of chosen mitigation strategies whereas differences in perceptions can create opposition. The perceptions of the participants will also be compared with the other results of the study to estimate how feasible the proposed, and possibly planned, solutions are.

5. Data collection and analysis

This study was carried out using qualitative research methods. Empirical data was gathered mainly with semi-structured interviews and partly by observation and open discussions which took place in the studied villages. Most of the material was collected in interviews with the villagers. They were a natural source of information as a major part of the study concentrates on their experiences of the elephant issue. As I was also interested of the views of the officials and other key stakeholders we tried to meet as many of these key informants as possible. The key informants were interviewed individually whereas the interviews of the villagers were conducted in groups. I considered it to be important to reach as many people as possible in the limited timeframe that I had for the data collection, and thus conducting group interviews was seen to be the best option. Besides the ability to gather information simultaneously from multiple respondents, group interviews can also generate deeper discussion about the topic compared to individual interviews (Hirsjärvi & Hurme 2009).

Conducting the interviews in the studied villages, and at times directly at the conflict sites, made it possible to make observations simultaneously. As I stayed in some of the villages for longer than just for the interviews there was time also for some open discussions of the studied topic.

The data from the interviews was later analysed with qualitative content analysis for the most part. Some of the questions in the villagers' interviews were formed so that their answers could be quantified as such.

5.1. Data collection

The main material of this study consists of the semi-structured interviews as outlined above. The interviews can be divided in two main groups: group interviews in which we interviewed the people who live in the studied villages (called hereafter village interviews), and expert interviews that were conducted with government officials and other key informants. The exact titles of the officials and key informants have been left out to ensure their anonymity. The interviews and the interviewees are presented in the table below.

Table 2. Summary of the interviews.

Interviewees	Occupation or other position	Total number of interviews
The villagers	Farmers, small store owners, stockbreeder, military personnel, nursery garden owner, members of local famers' organizations, monks, village eldest	64
Government department officials	FD officer in Nikapotha beat, DWC officer in Kalthota range, head staff member of Udawalawe National Park	3
Other key informants	Civil security force volunteer at Dahayagala corridor, head member of Welioya's farmers' organization	2

All other interviews except the one with the head staff member of Udawalawe had to be done with help of a translator. I was lucky to find assistants for this task through CEJ. The support from CEJ was in many ways essential. I would not have been able to access most of the villages without them or the help from their local contacts. In some villages that were located inside of the forest reserve we additionally needed to be accompanied by the Forest Department officers. Besides, it would have been challenging to get people to participate in the interviews if we

would not have been working with CEJ that has established good relations with the local villagers. Only in the areas where their organization is not that well-known some people were suspicious and refused to take part in the interviews. Before any of the interviews we first explained the purpose of the study and introduced the organizations (Shalin and CEJ) behind it and explained my student background and that the material from the interviews was going to be used in my master's thesis.

There is a possibility that sometimes the presence of CEJ staff affected the interviewees' replies. For example, it might be that opinions against conservation were not easily expressed. The possibility for this cannot be completely ruled out, although mostly the situation seemed to be the opposite: CEJ's presence (or explaining that the work is done in cooperation with them) created a trustful atmosphere where opinions were openly stated. People were in general voicing critique and frustration straightforwardly, for example against the DWC or the situation in general. It can also be stressed that group interviews are not the best option to examine people's perceptions as some more controversial views might be left unexpressed. Group interviews can also be 'hijacked' by a dominant person when the opinions of others might be left out (Hirsjärvi & Hurme 2009: 63). I decided to accept, and bear in mind, this risk as it was regarded more important to try to reach as many people as possible in the limited time that we had. The perceptions that were surveyed are also not personally sensitive but address more general issues, like the causes and solutions for HEC. Thus, I opted that it was more important to generate discussion than to survey these views individually.

5.1.1 Village interviews

Altogether 64 interviews were made in the 28 villages that we visited. These interviews included the total of 100 men and 36 women. Three fifths of the interviewees were between 41–60-year-old, one fifth from 61 to 70, and the rest either older than this or between 21–40-year-old. The interviews were structured in themes with mostly open-ended questions. This way it was possible to discuss the topics quite openly. Semi-structured interviews were preferred over tightly structured surveys as the studied phenomena was not well known and thus closed-ended options would have meant a risk of skipping important information. Looser structure allowed unexpected information to surface. Some structure was nevertheless needed for multiple reasons: open interviews would have been too time consuming, the predefined structure enables easier comparison between the stakeholders and different areas, and because

the interviews had to be done with the help of a translator. Having some structure in the interviews made it easier for me to follow and somehow control the discussions without the need to understand everything that was said. As the questions were predefined the assistants did not need to translate the whole discussion but just the replies related to the questions. This made it possible to keep the interviews proceeding smoothly which turned out important as the interviewees were getting easily distracted to other things if the exchange of words between me and the translator took too long. I decided not to record the interviews with an audio recorder as this can easily make the situation uncomfortable for the interviewee. The process of translating the conversations later would also have required extra hours of work from the translator, which is something that I could not afford. Thus, the answers were written or marked on paper after a set of question or a single answer during the interviews.

Originally we planned to have focus group interviews with premeditated mixed groups of informants: people with different backgrounds and with good knowledge of the local situation. Depending of the village's size the idea was to conduct from one to three of these interviews in each village. When we got to the study area it soon turned out to be infeasible to form these groups as participants were not easily available and in some of the villages we lacked the right contacts. I decided to stick to the plan of conducting group interviews but the participants we needed to find spontaneously in the end. Predefined selection of people was not feasible as it turned out to be difficult to find participants in many of villages. This was partly due to the ongoing paddy harvesting season which meant that many people were out on the fields for the days. Intervening in their work days was not regarded suitable unless they were found having a break. At times our way of proceeding resembled snowball sampling: we would often start the interviews with someone considered as a key person in that village (e.g. village eldest, local monk or a member of farmers' organization) and then proceed to other people that they believed to be well informed of the situation. However, often we needed to do the interviews randomly with whomever compliant we could find, as long as they were from the studied village.

Often we could find a group of people straightaway at the interview location, for example at a store, at fields or someone's home. In each interview we tried to include as many people as possible, women and men, but part of the interviews were also done with a single participant when no other people were at the site. In the end the interviews were planned so that they could be made with both individual interviewee and a group, with a presumption that the interviewed persons are aware of the HEC situation in their village. This criterion was easily met especially in the smaller villages as the elephant issue had plenty of importance and attention. Group

situations created typically more discussion, but they were not necessarily more informative. Depending of the interviewed person, individual interviews could be even more revealing. The interviewees were generally well aware of the HEC situation in their villages. Only for few it was difficult to consider the situation in the whole village. In these interviews the interviewees tended to give answers that mostly considered only their or their neighbours' experiences. If some interviews were not considered fully complete it was made sure that multiple interviews were conducted in that village.

The questions asked in the interviews concerned the frequency of crop raiding, the temporal variation, the type of damage, more closely which crops have been damaged and which not, about the other harm or problems that elephants cause, which measures have been taken to prevent crop raiding, what has worked and what not, what are the deficiencies of the used mitigation methods, what are the general and local causes for the conflict, what should be done to mitigate HEC, and questions about the responsibilities in solving the issue. These questions concerned the situation in the whole village, contrary to individual households' experience. The themes and questions are summarized in figure 5. The interview can be found in its full form in appendixes.

Like shown below, the interview was divided in different parts or themes. Each interview followed the same order which would be from left to right in the figure 5. In those villages where we conducted more than two interviews the background questions were asked only in the first two interviews. Only if there would be significant differences in these answers the same questions would be asked also in the later interviews. The part for background information was also skipped if the time for the interview was limited. In some of these situations we would ask the other questions first and then if time allowed go to the background part. Other than this the questions followed the same order but at times the interviewees would answer so lengthy that they would actually give an answer for multiple questions at the same time. Because of this the real order of the questions would sometimes change a bit and some questions were needed to ask a bit differently.

Background information	Impact of HEC	Perceptions I	Strategies to prevent elephant incursions	Perceptions II
• What are the main sources of household income? • Which type of agriculture is practised in your village? • What crops, trees and other plants has been grown in the village in the past 2 years?	• How often did elephants enter the area of your village in the past year, based on the cases that you know? • In which months elephants have caused damage to plants or to other property? What are the worst months for crop raiding? • Which plants have been eaten or damaged by elephants in the past 2 years? • Do elephants like some plants more than the others? Are there some plants that they don't eat? • How many families live in your village? How many of them suffered crop raiding by elephants in the past year? • How serious would you estimate the crop losses for elephants in your village? • Have elephants damaged other property in your village; caused injuries or deaths in the past two years? • Has there been cases of elephant injury or death in the area of your village in the past two years? • Are there any activities that people have gave up or avoid because of elephants? • Has anyone in your village applied compensations? If compensations were applied, did people receive them?	• Why do elephants enter the villages (in general in the larger area)? Are there any specific reasons in the area of your village? • Compared to earlier years has the conflict with elephants decreased, increased/intensified, remained the same as earlier? • What do you think are the reasons for increase or decrease?	• Which measures have been used to avoid elephant incursions into the village? Have they been useful? • If some measures have turned out not to work, can you specify why? • If electric fencing was used: What are your experience with electric fences? Do they help to solve the problem? Are there any downsides with electric fences? • Has the Department for Wildlife Conservation been working actively in this area?	• What should be done to mitigate the conflict between humans and elephants? Is there anything that could be done specifically in your village? • Who should be responsible for mitigating the elephant issue? Is it the villagers, the Department for Wildlife Conservation or some other actors?

Figure 5. The themes and questions used in the village interviews. Some questions that turned out unnecessary or difficult were left out or modified in the later stage of the interviews.

It was occasionally challenging to keep the interviews under control as the situations could be interrupted by for example someone's arrival, and because some of the interviewees preferred to discuss the topic openly without paying much attention to the questions and the interview's structure. Sometimes a question or two were missed or answers remained unclear because of these difficulties. Usually if an answer was not clear enough or if some surprising information came up additional questions were asked for a better understanding. The interviews lasted between 15 to 60 minutes depending on how much time the interviewee had and how much they had to say.

5.1.2 Key informant interviews

To understand the HEC situation more comprehensively, and from different angles, individual expert interviews were made with some of the key stakeholders. Most of the expert interviews used the same themes and partly the same questions as the village interviews. These interviews were however less structured and modified to consider the role of the interviewee, or mainly of his organization, in the elephant issue. The questions that considered the severity of the conflict, the used mitigation strategies and their effectiveness, the causes for the conflict and its resolutions were included in the interviews of most of the key informants to enable the comparison of opinions between them and the villagers.

As elephant conservation and consequently HEC mitigation is the responsibility of DWC it was clearly important to interview their personnel. One interview was made with the DWC's officer from Kalthota range. This range encompasses an area that extends on and beyond our study area. In addition to the main themes mentioned above the officer was asked about the elephant population living in this area and how they use the area, about elephant population development and the human-induced areal development, the quality and sufficiency of the natural environment, and questions related to DWC's responsibilities in HEC. The mitigation strategies were discussed especially in relation to what DWC does and what kind of short- and long-term plans they have.

The interview with the head staff member of Udawalawe National Park included similar questions as with DWC's officer: questions regarding the elephant population and their habitat, the quality and carrying capacity of the environment, and of the issues related to their maintenance. This interview had more emphasis on the elephants and the habitat management compared to the other interviews. As the national park has plenty of experience of the region's elephants and their conservation they were considered as the expert source for this information. Especially the potential mitigation strategies were extensively discussed from the conservation point of view.

Although Forest Department is not a responsible body in the HEC mitigation we wanted to interview their local officers as they typically have a good knowledge of all forest related issues in the area, elephants being one of them. In our short interview with one officer from Nikapohta beat we discussed how the elephants use the forest area and asked what the reasons for HEC in Bogahapalassa are and if there are any areal differences in the conflict. As livelihood

development programs, that could have a stake in HEC mitigation too, were mentioned in the Forest Management Plan (2006) I also asked if these have been implemented in some form. The elephant issue was also spontaneously and openly discussed with an officer from the wester beat in Bogahapalassa on our way to couple of the villages, but we did not have time for a real interview with him. Some interviews like this one have been left out from the study either because we could not successfully conduct the interview, or their results turned out to be irrelevant for the study.

The interviews with the representatives of the government agencies (the head staff of Udawalawe included here as the national park in administered by DWC) are central to this study as I was interested to compare their perceptions with the villagers'. Furthermore, as the aim was to understand the elephant issue as comprehensively as possible, we strived to interview other key stakeholders too when possible. One of the key persons that we got to interview was a head member of the main farmers' organization in Welioya area. In Sri Lanka farmers are typically organized in local level farmers' organizations that are each associated to a water tank that is used for irrigation. According this member of the greater Welioya organization there are 37 local level organizations under it and all together 2150 families are represented by it. Not all of these belong to our study area. This interview followed mostly the same set of questions as the village interviews but naturally considered an area greater than just an individual village. We also asked about the other challenges that farmers are facing to get an idea of how important HEC is in comparison to those. Areal differences between the villages and between different areas inside of the villages were further discussed. After learning that in Dahayagala the responsibility of the maintenance of the electric fence is on the Civil Security Force, a civil defence group working under the Ministry of Defence, we decided to interview one of their night watches at the corridor. This interview considered especially the challenges with the fence and other mitigation strategies.

5.1.3 Observation and open discussions

As we spent most of the days and part of the nights in the studied villages we had a chance to discuss the elephant issue openly with various people. I took notes in some of these discussions or dictated the key points afterwards in an audio recorder. The people with whom the topic was

discussed were mostly local farmers but also included one local level farmers' representative and a GM (Grama Niladhari) level agricultural officer.

Observations were made at times together with the interviews when the interviewee would show us for example some recent damages or the preventive strategies that they use. We also visited some damage sites and searched for spots where elephants had broken through the fence based on the information that we heard from the locals. Other general observations were also made of the surroundings. Once we came across an elephant in the middle of a day in one of the villages and got to witness crop raiding and the efforts to chaise the elephant away. It should be noted that observations were not made systematically. Together with the material from the discussions they are used as additional sources of information that helped me to further understand the issue and in some cases to verify some things that were mentioned in the interviews.

5.2. Data analysis

I have used qualitative content analysis (QCA) as the principal method for analysing the material from the interviews. Qualitative content analysis aims at bringing forth the information relevant for a research from a large amount of textual data. This data can be derived from all sorts of recorded communication including interviews. The main idea of QCA is to present the collected data in a condensed general form (Tuomi & Sarajärvi 2004: 105). It patches together scattered information from large amounts of text by combining notions that share similar meanings into categories. QCA is done by systematic classification process that moves step by step, from subcategories to main categories, towards higher level of abstraction, making the data easier to interpret. (Hsieh & Shannon 2005: 1278; Tuomi & Sarajärvi 2004: 109 – 114).

Qualitative content analysis is typically divided in two central approaches: inductive category development and deductive category application. Inductive approach is generally concerned with the creation of new theory emerging from the data. Deductive approach is by contrast aimed at testing an existing theory. Deductive analysis is strongly guided by previous research and theory whereas inductive analysis should be completely free from these. In deductive approach the categories are predefined by theory and the data is read in relation to these. Inductive approach in turn starts without any fixed or premediated categories. The categories are derived solely from the data by the researcher through systematic reading process. In

essence these two approaches follow opposite logical processes: deductive moves from general rule to specific conclusion and inductive from specific observations to general conclusion.

The hard division of inductive and deductive approaches can be questioned like pointed out by Tuomi and Sarajärvi (2004: 97). Firstly, it has been criticized that the possibility for 'pure' induction is questionable. Can new theory be created solely by observing data? Are observations not always selective, based on some previous knowledge? Tuomi and Sarajärvi (2004: 97) see that the main issue with this division is that it fails to recall the third logical approach, abductive reasoning. In their methodological guide Tuomi and Sarajärvi (2004) leave a side these general categories and introduce another classification first proposed by Eskola (2001). In this division *data-driven approach* can be understood parallel to inductive approach, and *theory-driven approach* corresponding to deductive. A third one, *theory-bound approach* kind of combines features of the other two. It has connections to theory without being completely based on it. Previous knowledge is recognized to influence the analysis but unlike theory-driven approach, theory-bound analysis is not aimed to test a theory but rather to open new understandings. It starts the same way as data-driven analysis by inductive category creation. So the categories are first derived freely from the data. Previous knowledge and theory may influence this process, but it should not lead the analysis or predefine the categories. In the later part of the analysis the notions picked from the data are considered in relation to the ready-known theory. The data-derived classes are related with the concepts that are defined by theory or previous research. (Tuomi & Sarajärvi 2004: 97 – 116)

In this research I have largely followed the theory-bound approach. The analysis, the way of reading and 'observing' the data, was clearly influenced by the knowledge of the previous studies of HEC. However, theory was not used to provide any readymade model that would have been tested, no clear framework or set of categories to be used. This is partly because of the complexity and the case specific nature of human-elephant conflicts. I also wanted to make it possible for any unexpected information to surface and thus the analysis of the interview material started inductively. It can however be commented that even the beginning of the analysis was not clearly data-driven as the data itself had already been so theoretically structured because of the way how the interviews were formed.

I ended up using two separate units of analysis. The answers for the questions that considered the situation in a certain village (mostly in the sections of background information and impact of HEC) are mostly analysed in village level. The village level results are derived from the

individual interviews which form the other unit of analysis. The perceptions that people have of the mitigation strategies and causes and solutions to HEC are for their part analysed not as perceptions presented by village but by individual groups of interviewees. The results are mostly explained open verbally, but I have also done some quantification based on the categorization to present some frequencies of the answers.

6. Results

6.1 Village livelihoods

The introductory chapter in the beginning of this text presented the general information about the livelihoods around Bogahapalassa. Similarly to the greater area, in the 28 visited villages the livelihoods centre around agriculture. People practise both subsistence farming and farming of cash crops in almost all the villages, and at least one of these two is part of the main incomes sources in every village. People also take part in agricultural wage labour at least in 23 villages, but unlike subsistence farming or farming of cash crops, in half of these villages it was mentioned only as secondary in importance. Most of the families have their own cultivations, but agricultural wage labour can provide additional earnings often seasonally or through part of the family. It should be pointed out here that when an income source is mentioned to be secondary, it means that for most of the village it is not the primary source of subsistence but can still be highly important for several individual families or additional for most of them.

Animal husbandry is quite uncommon in the studied villages. It was never mentioned as a primary source of village's income but in 11 villages it had secondary importance. Families rarely own livestock. Governmental jobs were considered central in 4 villages and secondary in 12. Private sector jobs were mentioned only in seven villages and always with secondary importance. Collection of non-timber forest products was mentioned only once as mostly additional source of income. The last general category that was mentioned is work with timber, mining or quarries which was part of the main income sources in six villages, in two of them with primary importance. All these fields are clearly secondary for the village economies when compared to agriculture.

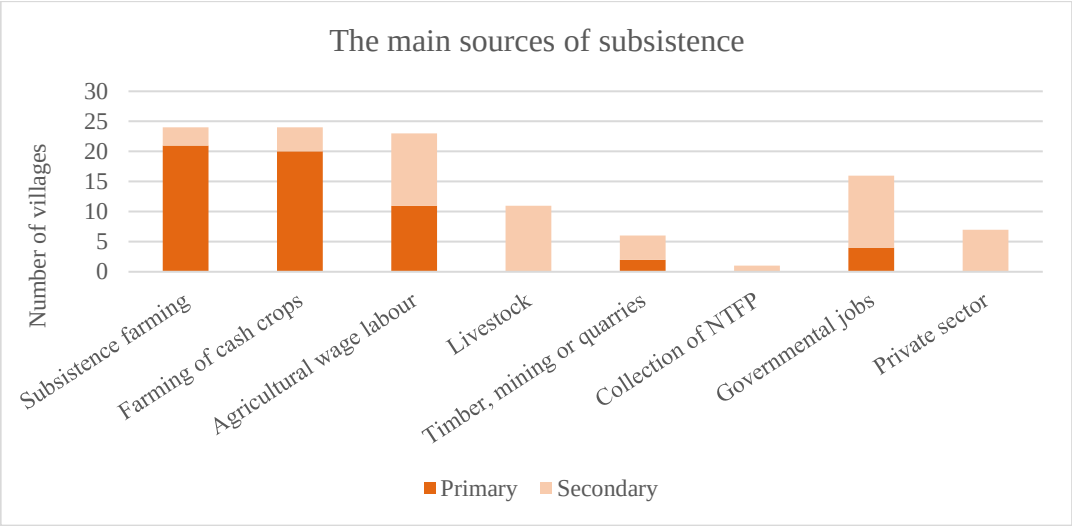

Figure 6. The main sources of subsistence in the 26 villages. Information missing from two of the studied villages.

Home gardens and paddy cultivations are common in almost all the villages. According to the village interviews, Parakumbayaya is the only village without any paddy fields. There are both irrigated and non-irrigated paddy cultivation in the area. Irrigation is more common in the southern side or Bogahapalassa where irrigation tanks characterise the landscape. The north-eastern villages of Kolongasthanna, Dehilanda and Mahalanda stand out as an area where none of the paddy is irrigated. Besides rice there are a range of other permanent crops cultivated outside home gardens. These cultivations existed at least in half of the villages (it was mentioned in 14 villages). According to the interviews, chena is practised in 17 villages all around Bogahapalassa.

Rice, banana and coconuts are the most dominant crops in the study area. They are cultivated practically in all villages. Rice, banana and coconuts were also generally considered to be the most important crops by the interviewees, either for sales or for families' own consumption. Other commonly cultivated plants (more than half of the villages) are corn, cassava, finger millet, peanuts, pepper, orange, mango and lime. All crops that had been mentioned at least in three interviews are shown in the chart below. The village interviews did not adduce any clear areal differences in the livelihoods and cultivation practices. It was anyhow quite evident from observation and discussions that the hilly north does not have that vast paddy cultivations as in south, and that pepper and rubber were more common in the northern parts of Bogahapalassa.

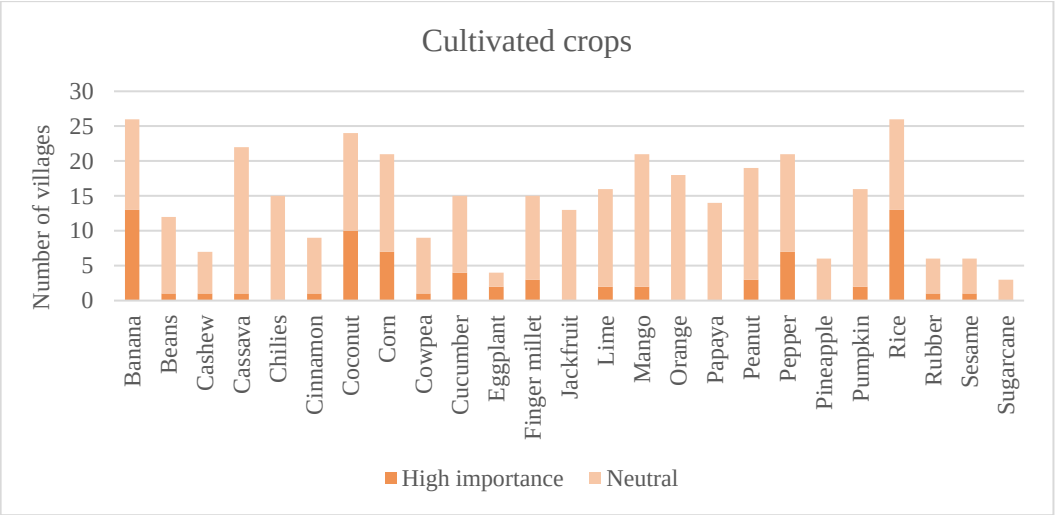

Figure 7. Cultivated crops presented by the number of villages in which they are grown. If some crop was mentioned to be especially important in the village, either for sales or own consumption, it has been marked with 'High importance'. For example, banana and rice were mentioned as especially important in half of the villages that grow them.

6.2 HEC's impact on village life

Under the theme of the impact of HEC the interview questions concerned the frequency and extend of crop raiding and other damages, and the temporal difference in their occurrence. As crop raiding usually causes most of HEC costs and because farming is the main livelihood in the area, the interviews included more specific questions about the damaged crops. This way we hoped to better understand which livelihoods and cultivations are possibly worse affected.

In this part the participants were first asked how often elephants entered the area of participants' village in the past year. The question was kept open-ended because the answers could not be easily placed into clearly defined categories. The responses varied between every day and rarely -type of replies, often with differences between certain seasons. For example, the interviewees described how elephants come almost every night during the dry season and the rest of the year a bit less, or that in the driest months they come every day and in the other months of the dry season more than ten times per month but the rest of the year only around once per month. Sometimes the answers were vague like that the "elephants raid crops around the year, at times more frequently but not often all the year". The respondents were at times asked to clarify if they meant for example that the frequency was more towards once per month or once per week, so that the risk for misinterpretation would not be that high. When considering these answers, it is good to keep in mind that people might exaggerate the situation, especially when the issue

raises strong feelings and opinions. I have categorized the answers in the analysis based on how often elephant intrusions happened in different times of the year.

In 60 of the total of 64 interviews the respondents reported of high occurrence of crop raiding at least in parts of the year –typically in the dry season. These interviews encompass all but one village, Dehilanda, where the interviewees told that elephants had been rarely in the village: according to one interview less than once per month and in another every three weeks or so. In the 60 interviews people stated that elephants had encroached into the villages the minimum once per week, at least in the worse months of crop raiding if not the whole year. In 20 interviews elephant intrusions were told to take place every day in the badly affected months, and in 13 interviews people said that this happens every day the whole year with no seasonal changes. Therefore, in around half of the interviews (33/64) people mentioned that elephants cause trouble every day at least during the worse seasons. Other 16 interviews stated that elephants had entered the village every week the whole year with no noteworthy difference between the months. Based on these answers, the intensity of HEC seems to be very high at least in those months when crop raiding happens the most.

The main dry season was generally seen more problematic than the rest of the year. People defined these months a bit differently: some broadly from May to October (the duration of southwest-monsoon when these parts of the country are experiencing mostly dry weather) where as others in a shorter period typically leaning towards the end of the season (July to September). August is the driest month in the area and it was also clearly seen as the most problematic time with elephants by most respondents. The ripening and harvesting time of paddy in the beginning of the year (typically from December or January to March) was mentioned in four interviews as another peak time for crop raiding.

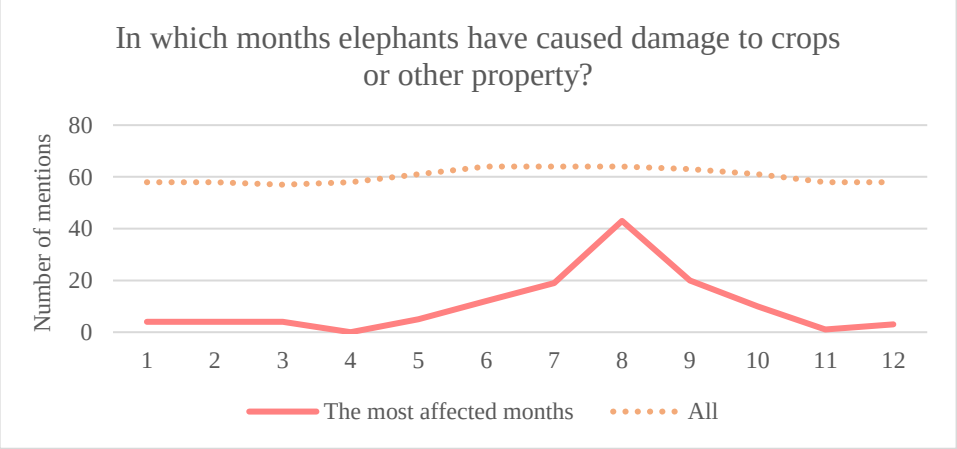

Figure 8. The number of replies to the question of "In which months elephants have caused damage to plants or other property? What are the worst months for crop raiding?".

Besides the peak times, elephants raid crops in most of the villages around the year in some extent. Two thirds of the interviews concluded that elephants had entered the villages on average at least once per week in every month. Almost another third mentioned that elephants had been in the village the minimum once in every month. The only four interviews in which the answers were that elephants rarely (less than once per month) came to the village outside of the main crop raiding months (n=3) or in the whole year (n=1) took place in Parakumbayaya, Kandiyapitawawa and the earlier mentioned Dehilanda. In all three interviews that were made in Parakumbayaya the people said that elephants come to the village repeatedly during the dry season but rarely (in 2/3 interviews) or around once per month (1/3) the rest of the year. In Kandiyapitawawa it was told that elephants can come even every day in the worst months of the dry season, but in other seasons they had come once per month (1/2 interviews) or less than that (1/2). Thereby Kandiyapitawawa and Parakumbayaya can tentatively be presented as villages where HEC appears mostly as a seasonal issue.

There are 11 villages where all the interviewees shared the view that they are having issues with elephants every week around the year. The villages are Alakolamada, Aluthwela, Kilimunna, Kologasthanna, Madabadda, Mahakiwla, Pathaha, Ranwanguhawa, Siripura, Ussalla and Waeliya. I will consider these tentatively as possible high conflict areas in the later part when comparing these perceptions of the frequencies with the other results of the interviews. It should however be noted that because of the small number of interviews and freely descriptive nature of the answers, there might not be real significant difference with some other villages where the answers were more moderate.

I will next focus on the crop losses caused by elephants. The village interviews had two questions that were meant to examine which crops are being damaged and which plants in turn are not raided by elephants. There are also other animals that cause crop losses, but our questions were limited to elephants only. Figure 9 below presents the crops that have suffered damages and the number of villages where these damages had occurred. I have also included the sum of villages where these crops are grown in the chart for comparison, as the prevalence of their cultivation naturally partly affects how likely they are to get damaged. The question we presented asked “Which plants have been eaten or damaged by elephants in the past 2 years?”. Thus the crops shown in the chart were not necessarily eaten but could have been damaged otherwise. For example, chilies were often reported to be stomped over by the elephants but not eaten.

Virtually all crops that are grown in the studied villages were said to have suffered damages. Most of the crops are suitable for elephants to eat and presumably majority of the damaged crops also were eaten. The citrus fruits of orange and lime, and chilies, cinnamon and rubber were typically said to only have suffered damages when elephants had walked through or on them. Although elephants are not attracted to eat chilies, the low plants had often been destroyed by crop raiding elephants. There are some crops that have been damaged basically in all the villages where they are cultivated. These are rice, corn, cassava, banana, coconut and pumpkin. The other crops were damaged only in part of the villages that grow them. The relation of damage occurred to the prevalence of the crop in a village level is clearly smaller for some plants. That indicates that they are raided relatively less than the others. This seems to be the case with cinnamon, orange, pepper and lime.

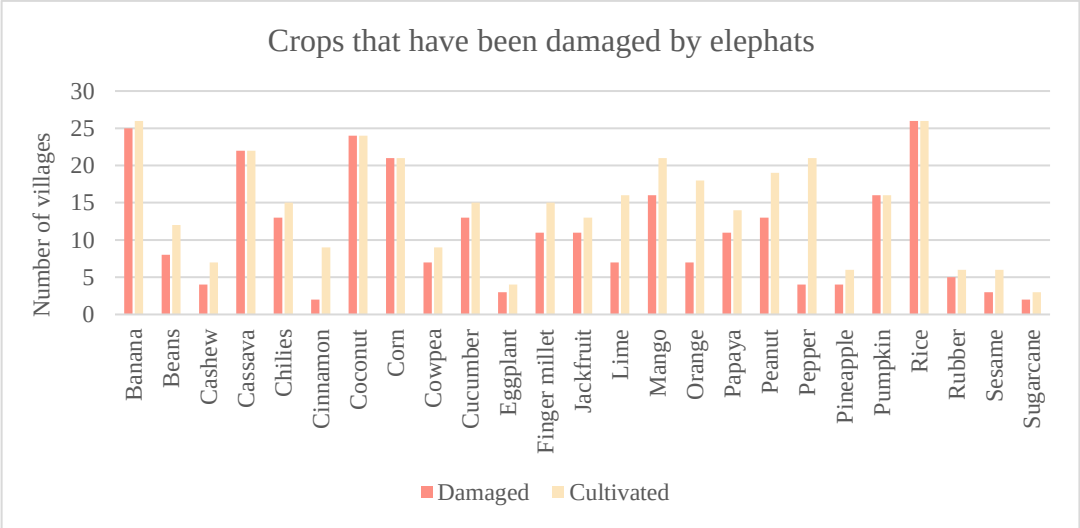

Figure 9. Damaged crops. Red bars present the number of villages where elephants have damaged certain crops. The yellow bar presents the number of villages where these plants have been grown as a comparison.

It is clear that these interviews could not capture the real frequencies of raids on certain crops or the amount of losses related to each crop. Neither was this intended. The numbers shown in the figure above can anyhow suggest which cultivations repeatedly suffer losses and which not. To get a still better idea of which crops are more problematic we asked the interviewees if they think that elephants like some plants more than others, or if they think that there are plants that they do not eat. People had a clear idea that elephants do not eat lime, chillies, orange and pepper. Cinnamon and rubber were also mentioned several times. On the other hand, elephants were said to come to the villages especially for paddy, banana and coconuts. It was also quite often believed that they prefer corn, cassava and pumpkin.

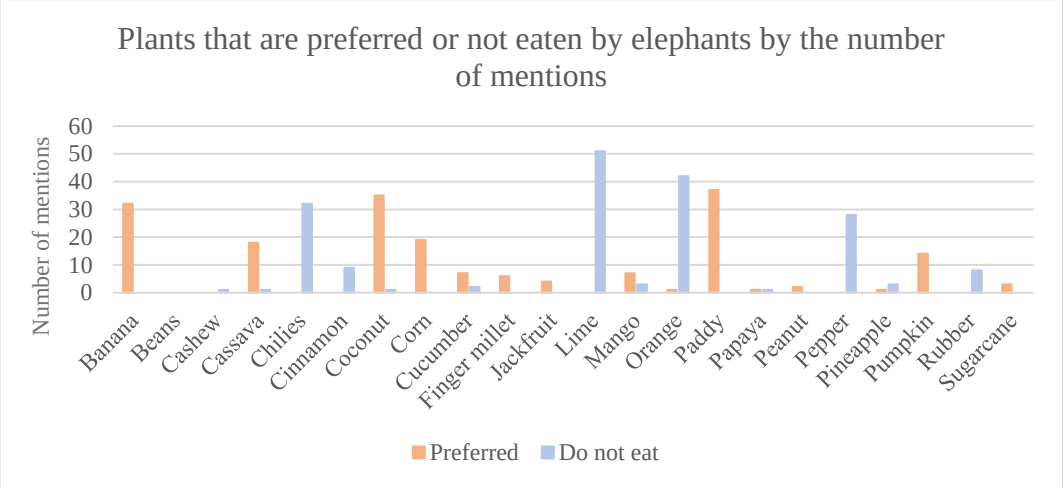

Figure 10. Crops that people believe are either preferred or not eaten by elephants.

In general, the interviewees perceived the crop losses to be substantial. Two questions in the interview addressed the perceived extend of the crop losses. We first started by asking how many families live in the interviewees' village and how many of these they thought to have suffered crop losses in the past year. More than half of the answers (35/61) stated that all families had suffered losses. This view was shared by all interview participants in 7 villages. In other 7 interviews more than three quarters were said to have lost crops to elephants and in four the number were thought to be somewhere over half of the families. Altogether in 20 villages all interviewees agreed that over half of the families if not close to all had suffered losses. Again in seven interviews people believed that less than one quarter of families lost crops to elephants, and in three people thought that only few families in their village were affected. When scrutinized on the village level, the results show that there are two villages where the interviewees answered that less than half of the families had suffered crop losses: Mahanetula and Neliyana. In other two villages the respondents shared a view that just a minority, less than one quarter of the families, were affected. These villages are Kandiyapitawawa and Parakumbayaya. In Dehilanda both of the two interviews that were made there concluded that only few families had suffered losses. Kandiyapitawawa, Parakumbayaya and Dehilanda are the same three villages where the frequency of elephant intrusions was mentioned to be lower than in the other studied villages.

We also asked the interviewees to estimate the severity of crop raiding. Here we used ready-defined options for answers: serious, moderate, minor or none. Serious was defined so that "the losses are frequent and they seriously hinder the subsistence of many families". Moderate was explained so that "crop losses are reoccurring and fairly big but families still get along with the

remaining harvest", and with minor "small amount of crops are lost at times but it does not affect people's lives much". We tried to use easily understandable but as similar definitions as possible in Sinhalese. Most of the interviewees assessed the losses to be serious (50/64), in nine they were rated moderate and in five minor. In 22 villages all groups estimated the conflict to serious. In three villages the answers varied in the interviews either from serious to minor (=2) or from serious to moderate (n=1). In two villages the severity of the conflict was given a moderate rank by all interviews, the villages being Kandiyapitawawa and Parakumbayaya. Dehilanda is the only village where the interviewees ranked the severity of HEC to minor level. The results from the past sections suggest that in Kandiyapitawawa, Parakumbayaya and Dehilanda there are possibly less issues with elephants, or at least the HEC is not perceived as serious as in other villages.

Besides crop raiding we asked the people about other direct and indirect costs caused by elephants. In the past two years elephants had caused property damages in 24 villages. It was common in these cases that an elephant had damaged a house or a storage building when trying to access the food inside. People told that the elephants can smell food from inside the houses to long distance. They would come often during the night and break through a wall stealing the food or in some cases salt minerals from inside. Some guarding huts and fences had also been broken by elephants. Human injuries were reported in 12 villages. In some cases the people had simply fell down when escaping an elephant, but few situations had also lead to more serious injuries when people had ended up in close contact with elephants. At least in one recent case this had happened when a man was guarding his fields during a night when an elephant had suddenly appeared next to his hut and destroyed it. Human deaths were also reported in some villages, but these incidents could have had happened already some years ago. In 11 interviews people were also aware of elephant injuries or deaths. Often it was difficult to say where the injuries had come from but in few cases people believed that traps had been used or that elephants might have been shot.

Figure 11. Examples of two damaged houses. In both cases an elephant had broken the kitchen wall to steal rice from inside.

Of the 28 studied villages in 25 of them people mentioned different indirect costs caused by the HEC. I have categorized these in six general categories. Two of the categories with most mentions are related to changing farming practices because of continuous crop raiding by elephants. In eight villages some farmers had *decreased the area of their cultivations*. Usually they were forced to abandon some fields that had been problematically located close to a forest border or in the forest and thus often exposed to crop raiding. In around half of the villages (n=15) there where famers that had *stopped cultivating certain plants* that had been raided by elephants too often. For example, it was told that in Kumarathanna most of the families used to grow sugarcane but now all have stopped that because of the elephants. In at least half of these cases the interviewees mentioned that the people had started to grow some other plants instead. Cassava, bananas and coconuts are the ones that people gave up the most often. Pepper was the most typical replacement. Some had adopted oranges, lime, peanuts or eggplant over the ones that had been raided often.

The presence of elephants complicates the village life also in ways that are not directly related to agriculture. The interviewees in 7 villages reported that *elephants restrict people's movement* in a way or another. Based on the open discussions with some villagers this seemed to be the case also in some other villages where it was not brought up during the interviews. It was often mentioned that it is risky to move outside when it gets dark because there is a high chance of encountering an elephant. Because of this people usually stay at their homes in late evenings and nights or avoided certain roads and areas where elephants have been spotted. One interviewee for example told that they would not leave their house in the night even if they would need to go to a hospital, because they could get easily attacked by an elephant on their road. Some routes close to a forest border and the corridor were also considered dangerous even during the day time. Elephants enter human areas mostly only during the night, though in Aluthwela they were told to come during the day too. We also run into an elephant on a road in Aluthwela in day time and were forced to turn back with our three-wheeler.

In at least four villages some of the residents had *moved out* or to different areas in the same village because of the continuous issues with elephants. For example, the interviewees in Alakomalada told that 45 families that earlier lived close to the interview location had moved out further away from the forest. Only six or seven families had stayed. In all four villages the residents that moved away had earlier lived either in the forest or at the border area. One interviewed person whose house was attacked just a previous night had also been considering moving away because of the elephants in the area.

There are also other indirect costs that were maybe not easily expressed in the interviews. It seemed to be common that people *stay up the nights guarding* their fields, but it was rarely mentioned as a hindrance (only two times). Correspondingly, later in the interviews when we asked for different methods used to prevent crop raiding, guarding as such was not that often mentioned although it was most likely quite common (for example tree houses used for guarding were sometimes mentioned but guarding itself not). Seems like it was taken for granted and thus was not usually considered either as a hindrance or as a specific method against crop raiding. HEC can also cause *emotional distress* but together with this question it was mentioned only once. The interviewees described that the everyday difficulties that HEC brings make people distressed. There were signs of similar thoughts in other discussions and interviews too, but they were not directly stated in these replies.

On the grounds of these results, it is evident that the whole study area is affected by the elephant issue. The villages are in many ways homogenous in relation to HEC. Elephants raid crops throughout the year but especially in the dry season when chances for elephant encounters are high every night. In almost all villages people perceive the crop losses to be substantial. Close to all cultivated crops have been damaged by elephants, the only clear exceptions being lime, orange, pepper and cinnamon. This suggest that the families who concentrate cultivating these plants, instead of paddy for example, might suffer less agricultural losses (at least to the main crop raiding animal, elephants). The village interviews did not reveal clear areal differences in the occurrence of HEC, which might be also due to how the data was gathered. There might be less conflict in Kandiyapitawawa and Parakumbayaya at least during rain seasons, and Dehilanda possibly has the least of elephant problems throughout the year. These villages are located in different parts of Bogahapalassa and right next to other villages where the conflict was perceived severe and continuous. The livelihoods in these three villages are similar to the others. Based on these results it cannot be exhaustively argued that these three villages would have less issues with elephants. The results suggest that, but there is a risk that the interviewees in these villages simply had more moderate views of HEC. The other group of villages that I tentatively named a possible high conflict area did not show any difference compared to other villages in the later set of results.

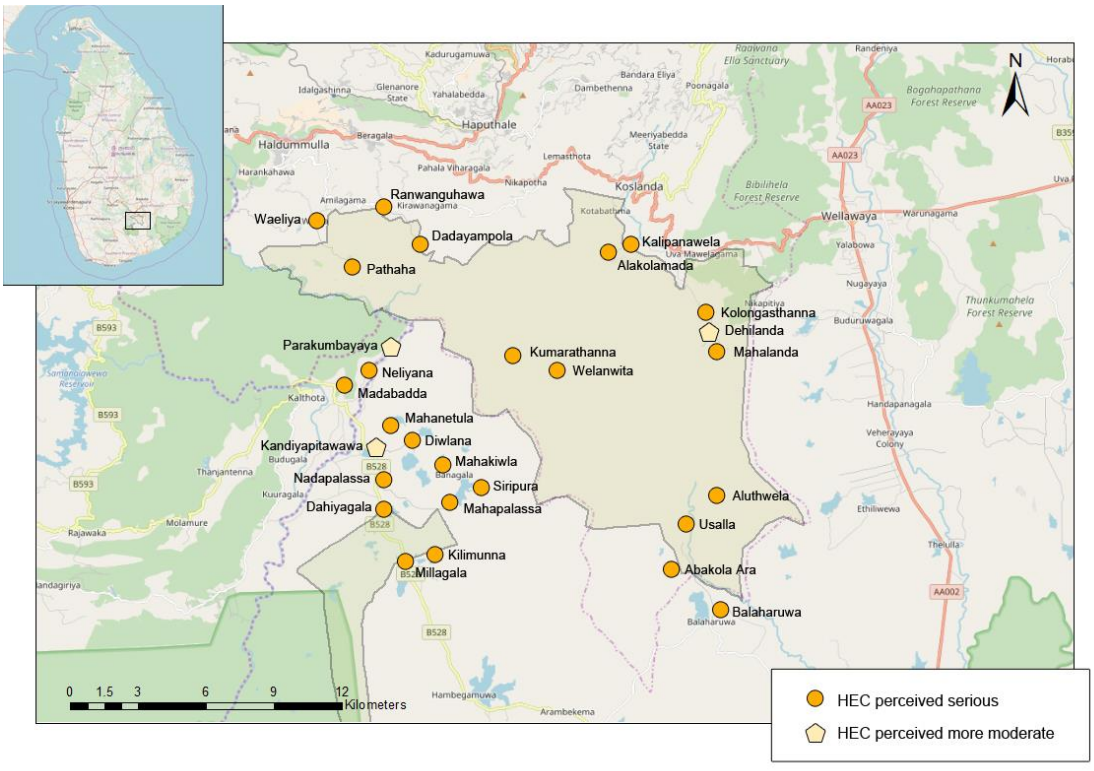

Figure 12. HEC was perceived somewhat more moderate in three of the studied villages.

6.3 HEC mitigation strategies

One of the main sections of the interviews focused on the different strategies used to mitigate the HEC. The questions under this theme considered the ways how farmers individually or collectively try to prevent crop raiding, what kind of measures DWC has taken, and how these mitigation strategies and methods have worked. As electric fencing has been given a high priority in the national HEC mitigation strategy, and because it quickly became evident that it played out a main role in the conflict's resolution in our study area, the interviews included a specific question of its functionality.

The first question asked "Which measures have been used to avoid elephants' intrusions into the village?". Together with this we asked if the interviewees considered these methods to be effective. When elephants have been spotted in a village people typically try to scare them away by shouting and throwing firecrackers at them. Families also receive thunder flashes from DWC. These are kind of large firecrackers especially made to scare away elephants with a loud bang. Thunder flashes were often considered important for crop protection. They are distributed to all the villages in the study area.

Figure 13. A thunder flash ready to be lit.

In 21 villages people mentioned to also use flashlights to scare away elephants and to see them easier in the darkness. Few participants told that at times it is enough to just point the light at elephants and they would go away when being exposed. Fires were also used in most of the villages. These can be used when chasing elephants away but also as a preventive measure. Fires next to fields have been used to create unpleasant smoke, though this was mentioned rarely in the interviews. Like shortly mentioned earlier, people usually guard their fields during

the night. This was considered essential by some interviewees. If the fields are left unguarded substantial losses can occur in single night. Tree houses are common in the studied villages. They give protection and a better view over the cultivations.

Figure 14. A tree house overlooking a banana cultivation.

Some families have fences around their home gardens and other cultivations. They typically not intended to stop elephants, but in part of the villages (n=11) the interviewees told that some people hang noisy objects in fences or ropes so that when an elephant or some other animal crosses the fence it alerts the people who guard the fields and potentially even scare the crop raiding animal away. Half of the villages reported to have the electric fence provided by DWC. These villages are located on the south side of Bogahapalassa or in the forest reserve. Private electric fences were mentioned to be used in as many villages, many of them being a village with both private and DWC's fences. Private fences are used to protect both collective cultivations and individual farmer's fields.

Figure 15. DWC's electric fence bordering an irrigation tank.

Only one farmer told that he has purposefully planned the order of crops so that the plants that attract elephants are grown further from the forest behind other crops that work as a buffer. In one interview people mentioned the use of explosive traps (hakka patas). These are apparently originally used against wild boars. With these traps an explosive is placed in fruits or other food and when eaten it detonates. Few people also mentioned some other improvised methods. One farmer told for example that he soaks pieces of clothing in kerosene, wraps those around rocks and when an elephant comes to his fields, he lights them up and throws them at elephants. Couple other farmers said that they use a tractor or dogs to scare elephants away.

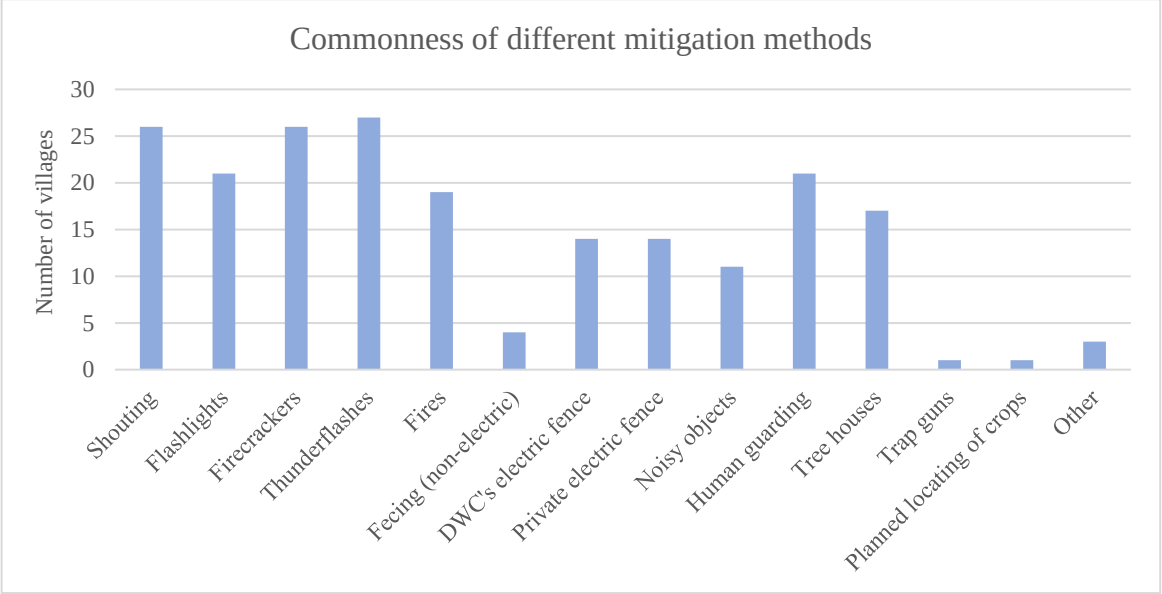

Figure 16. The methods used to prevent crop raiding by the number of villages in which they have been used.

Most of the methods that have been used to protect the villages and fields were considered to be useful to some extent. Especially thunder flashes and firecrackers were thought to be important in scaring elephants away. Many people also believed that electric fences can effectively block elephants. Trust was generally higher with private fences. However, even when some methods were considered useful or important, they were often mentioned to have deficiencies too. Thus, people's experiences with the different mitigation measures are not unequivocal.

There were many stories of how elephants are not always scared of people and the traditional deterrence methods they use. Altogether in 20 interviews people expressed that it is difficult to chase the elephants away from their fields because of this. Especially shouting and lights were considered inadequate on their own. Firecrackers and thunder flashed increased the chances of shooing the elephants but if was often mentioned that even these methods are losing their power.

For example, two separate stories described how two thunder flashes were used to scare off an elephant, but the elephant would not care and instead continued eating. When we came across the elephant in Aluthwela people tried to drive it away by shouting and throwing firecrackers right next to it, but the elephant did not mind at all. When people eventually started to throw rocks it first got away from the field but then charged towards the people on the road. One farmer also told us how an elephant had continued to destroy his garden until the officers from DWC came to the scene and loaded their gun. The sound from the gun seemed to be the only thing that finally frightened the elephant. It should be noted here that DWC does not shoot elephants, but it was known that elephants recognize the sound of a gun, for example when it is being loaded, and are afraid of them. In few interviews people also told that elephants have in some encounters followed the people with flashlights instead of being afraid of them. There were signs of some elephants getting more aggressive when people try to chase them off.

A lack of a sufficient amount of thunder flashes was also a fairly common complaint (around every sixth interview). The two or three thunder flashes distributed to each family was considered to be too little. Some interviewees told that even when people manage to drive the elephants back to the forest they might just hide for a while and come back later. When this happens, the families might already have run out of thunder flashes. In four interviews people also told that the process of applying for thunder flashes can be complicated and slow.

I will next turn to the result of the question that addressed specifically the experiences with electric fencing. The electric fence that has been deployed by DWC has many deficiencies according to the interviews in all the villages that had the fence. Most of the stated issues with the fence were related to bad maintenance (n=16) or lack of power (n=19), two things that are closely interlinked. It was also often mentioned (n=11) that elephants can easily break the fence, partly because the fence is not made well enough and because elephants are clever to find weak spots in the fence. In four interviews the respondent pointed out that the uncovered poles are easy targets if they are not strongly set into the ground. The issues with maintenance seemed often to relate to slow repairing of the fence after it had been broken. Some people also said that the undergrowth gets sometimes too long so that it touches the fence and breaks the electricity. For a reason or another, every now and then the fences had been off, thus allowing the elephants to break through them easily. The solar panels were often thought to be problematic. Four interviews told that in rain season when the sky is cloudier the panels are not batteries are not storing enough power from the day. The part of villages that are located in the middle sections of the fence are especially lacking power. It was told that close to the power

stations where the panels are located the fence normally has a strong current but the further away a fence is located the more likely it is that the current is weak or missing. Hence some people suggested that there should be more power stations and batteries generating electricity.

In six villages the interviews also stated that the DWC's electric fence is problematically placed. In Kilimunna it was said that the fence covers only part of the village leaving the other part vulnerable to crop raiding. The fence cannot be extended because there is an ongoing legal case about land rights that is preventing the fence of being built on these lands. In Millagala, Kandiyapitawawa and Dahayagala that are adjacent to the corridor people stated that fenceless spot along the road that cuts through the corridor allows elephants to enter the villages. These spots are guarded by the civil security force, but the interviewees told that they cannot stop the elephants in any way. The interviewees in Balaharuva stated that also there the elephants are using the road that leads to the village. The fence is located so that elephants can access the road but the road itself has no barriers to stop elephants. Some interviewees in Aluthwela also believed that there is a spot close to their village where elephants can avoid the fence.

Private fences were often considered to effectively prevent crop raiding. People trusted them better than the DWC's fence because of the various problems that it has. Some families have invested in their own electric fences even where the villages are covered by DWC's fence. In one village I was shown a paddy field that had been fenced with private fences even though there was the fence from DWC just meters away. A local farmer explained that they need the second fence because the DWC's fence is broken too often. One clear downside of the private electric fences is their cost. There are many families that cannot afford them. Besides their high price, we heard the only complain of private fences in Alakolamada. There an interviewee told us that after one wealthy farmer had built an electric fence around his fields there were more elephants coming to the other parts of the village where the problems piled on other families.

The compensation scheme was widely criticized. In 44 interviews people mentioned that 32 of these interviews it was told that compensations had not been received. When the people were compensated the payment that they got was often considered to be little. Some interviewees told that they had to spend more money in the process of applying compensation than what they eventually received. Others mentioned that they do not even try to apply any compensation because of these issues: either they are not paid at all or the compensation will not pay back the effort. The compensation process was also considered to be slow and complicated. One reason for the high number of complaints could be that the people seemed to be badly informed about

the scheme and what is currently included in it. In most of cases it was mentioned that compensations were applied for crop losses although currently these should not be covered by the scheme. Few interviewees knew to say that crop losses had been compensated some years before though not anymore, but most seemed to still believe that these losses would be compensated.

6.4 Perceptions of the causes of HEC and of what could be done to mitigate it

This section starts by introducing the factors that the villagers believe to be causing the conflict with elephants. I will also present their views of how the conflict has developed in the past years before turning to the perceptions that they hold of the possible solutions to this issue. We approached the perceptions of the causes by asking the interviewees what they believed to be the reasons for the elephants to intrude into the villages, firstly in general in the greater area and secondly more specifically around their village. Further questions were asked about the changes in past years, if the respondents believed that the level of conflict has increased or decreased and if so, what are the reasons for that.

6.4.1 The perceived causes

The answers for the question about the reasons for elephants to ingress into the villages are categorised in the table below. The main categories define the reasons in more general level. The answers that specified more closely what are the factors behind the more general causes are presented as subcategories. For example, some interviewees told that the lack of food is why elephants come to the villages without defining what causes this shortage. These types of answers count only in the main category. Others defined more precise reasons, saying for example that spreading of lantana is diminishing the food supply in forests which makes the elephants to search for alternative sources in the villages. This is counted in a subcategory and its main category. The answers typically included more than one cause, like can be expected. Most of the categories are by some means interlinked, although their connectedness was normally not mentioned by the interviewees. For example, in general level the human induced degradation of forest areas has negatively affected the availability of food and water in natural habitat which can further have changed the grazing behaviour of the elephants. There seemed to be a strong understanding of this interconnectedness even if this was not typically mentioned.

Table 3. Perceptions of what makes elephants to enter the villages categorised in main and subcategories.

Categories	Count
Human induced deforestation and degradation of forest areas	**18**
1. Illegal cattle grazing	8
2. Increased human population and settlement	6
3. Illegal tree felling	1
4. Forest cleared for rubber or pepper plantations	1
5. Government's big development projects	1
Lack of water resources in the forest	**20**
Lack of nutritional resources in the forest	**33**
1. Spreading of invasive species (lantana)	8
2. Forest fires	5
3. Human induced degradation of the natural area	4
4. Mana vanishes in dry season	2
5. No access to the saltlick in Bogahapattiya	1
Elephants' behaviour	**25**
1. Elephants prefer the plants grown by people over the ones found naturally in forest	8
2. Elephants released from the orphanage a special case	8
3. Elephants are habituated to find food from the village areas	4
4. Elephants brought from elsewhere (including orphanage) are not well habituated	3
5. Elephants are used to interact with humans, are not afraid of them anymore	2
Villages located on elephant territory	**6**
Weakness of government institutions to handle HEC	**1**

One of the elephant issue's main causes that people mentioned is the human induced deforestation and degradation of forest areas. The long-term trend of human settlements and cultivations spreading deeper in the forest has been decreasing the forest cover around Bogahapalassa. The government's big Mahaweli development project south from Udawalawe was also mentioned in one interview to have drastically reduced elephant habitat. As the more current reasons behind the degradation of forest areas people mentioned the forest clearing for rubber and pepper plantations (n=1) and illegal cattle grazing (n=8) and tree felling (n=1) in the forest.

It was commonly understood that the lack of food, and less often water, in the natural habitat drives elephants in to the villages. Both natural and human-induced development were believed to cause this. According to the interviews, one big issue in the study area is the invasive plant species called lantana. It has been replacing endemic plants like mana (a type of a grass plant) that elephants consume normally. Lantana was thought to have been spreading fast and widely

in Bogahapalassa and other forest areas. Forest fires were also told to contribute in the shortage of natural food. In one interview the people claimed that these fires are sometimes set purposefully by hunters. Forest fires occur mostly in dry season. Many interviewees believed that food and water are also naturally scarcer in dry seasons because the water tanks dry and mana wilts in the forest. The reasons for the lack of water sources were typically not defined but in one interview the farmers told about a tank in Bogahapalassa that had been damaged by people and could no longer hold water. Some interviewees defined more closely that human-actions in the forest areas have caused the depletion of elephants' natural food. It was also mentioned once that because of the expansion of human settlement and cultivations elephants have no longer access to a saltlick in Bogahapattiya, and thus they search for minerals from people's storages. In six interviews the people also mentioned that the villages are located in elephants' traditional habitat and because of that the elephants come there regularly.

Different features and changes in elephants' behaviour were commonly believed to play their part in the issue. These views largely reflect the findings that have been made in HEC studies. Firstly, elephants were thought to prefer the plants grown by people over the ones found naturally in the forest. The interviewees typically referred to their better taste, but the nutritional values are also higher with the plants that farmers grow. Secondly, we were told that elephants are now so used to find food from the villages that they come there habitually. The elephants are also more accustomed to humans and because of that they are not scared to enter the villages. More surprising and specific to this area were the mentions of certain groups of elephants that are more often the cause of trouble. Many of the people who live close to Udawalawe believed that the elephants that have been released from the elephant orphanage which is located close to the national park are the ones causing most of the damage. People said that these elephants that were taken care by humans are so used to people that they are not frightened to interact with the villagers. It was also believed that in the orphanage they have been fed with fruits and other crops grown in the villages and because of this they no longer like what can be naturally found in the forests. In three interviews it was also mentioned that besides the orphanage elephants there are some other relocated elephants that do not know how to live in their new environment. Because of this they come to the villages where food and water are easily available.

More proximate causes for the elephant issue in certain location were mentioned only in 18 villages. In most cases they were simply either that the village is located close to a forest border or that elephants get to the village because the village's electric fence is not working properly.

Nearby water sources were told to attract elephants in four villages. There is the small Weli Oya river that runs in the south-western side of Bogahapalassa down towards Uwadalawe. The interviewees in Parakumbayaya, Neliyaya and Madabadda told that elephants come to their villages to drink from this river. Elephants also drink and bath in irrigation tanks in other locations. The tanks close to the forest border at Siripura were told to be one reason why elephants come specifically there. In addition, other interviewees said that Siripura is located on a natural elephant corridor and thus the elephants are used to come there. Together with Siripura, there are another four villages in this same area where the people told that after establishing the Dahayagala corridor and subsequently erecting the electric fences in the area, the villages next to the corridor are suffering more of the elephant intrusions. The people in Mahakiwla, Mahapalassa, Dahayagala, Nabadapalassa and Siripura believed that now when the elephants have limited access elsewhere there are more of them at the corridor which makes the HEC situation worse in the villages next to it. Similarly, some interviewees in the norther village of Kalipanawela told that after Welanwita, that is located in the forest reserve south from Kalipanawela, had been fenced more elephants have been coming to their village which has no electric fence. Thus, it seems that the electric fencing has steered the issues more to certain locations.

The expansion of pepper and rubber cultivations in the northern side of Bogahapalassa has partly contributed to the HEC in Kalipanawela and Pathaha according to the interviews in these villages. The respondents believed that clearing of rich forest for the cultivations has diminished the natural food sources of elephants, driving them to villages in search for food. At the other side of Bogahapalassa, in the villages of Mahanetula and Kandiyapitawawa, some interviewees mentioned that there is a noisy quarry run by a private company nearby in the forest. The respondents believed that here the elephants are distracted by the quarry and consequently driven towards the villages.

Most of the interviewed villagers believed that problems with elephants have grown in the past years. In 11 interviews the people concluded that the level of conflict has remained the same as in the past, and only in three interviews we were told that the problems have decreased. With all three cases the people in the other interviews from the same villages believed that the conflict has increased. The reason mentioned for the decrease was in two interviews the expansion of settlements around the village. The interviewees believed that there are now less elephants because the surrounding settlements work like a buffer where people chase the elephants away. The electric fencing was thought to have lessen the issues with elephants in one interview.

Interestingly this was mentioned only once where as in all the other villages that have the fence people still thought that the situation is worsening even if they are protected by the fence. The perceived causes for the increase of conflict were typically the same as the general causes for the conflict in the first place. Deforestation and degradation of forest areas has been reducing the elephant habitat and the availability of natural food and water. The elephants that have been released from the orphanage or brought from elsewhere were often mentioned to have increased the incidents. Some people also believed that the elephant population has grown, and others mentioned that the more the elephants have habituated to crop raiding the more issues there are.

6.4.2 Proposed mitigation strategies

The last part of the village interviews asked people's perceptions to what should be done to mitigate the HEC. Even though DWC's electric fences faced plenty of critique in the earlier parts of the interviews, electric fencing was by far the most supported mitigation measure. Besides, in all the 40 interviews where it was mentioned people wanted the fence from DWC. Only one interview partly differed, with the interviewees stating that if DWC cannot provide the fence then private fences should be subsidised for the farmers. There was a clear difference between the villages with and without DWC's fence in the way how people defined their answers about the electric fencing. In the villages where there are not yet fences people perceived them as such to work as a solution. They wished that DWC would soon build fences to protect their villages without further defining how the fence should be. On the contrary, there where the electric fences have already been built the interviewees specified how the fencing should be made better. It was mentioned that the fences needed to be stronger, with better power supply and enhanced maintenance. Electric fencing was seen important for HEC mitigation, but the current state of it was inadequate.

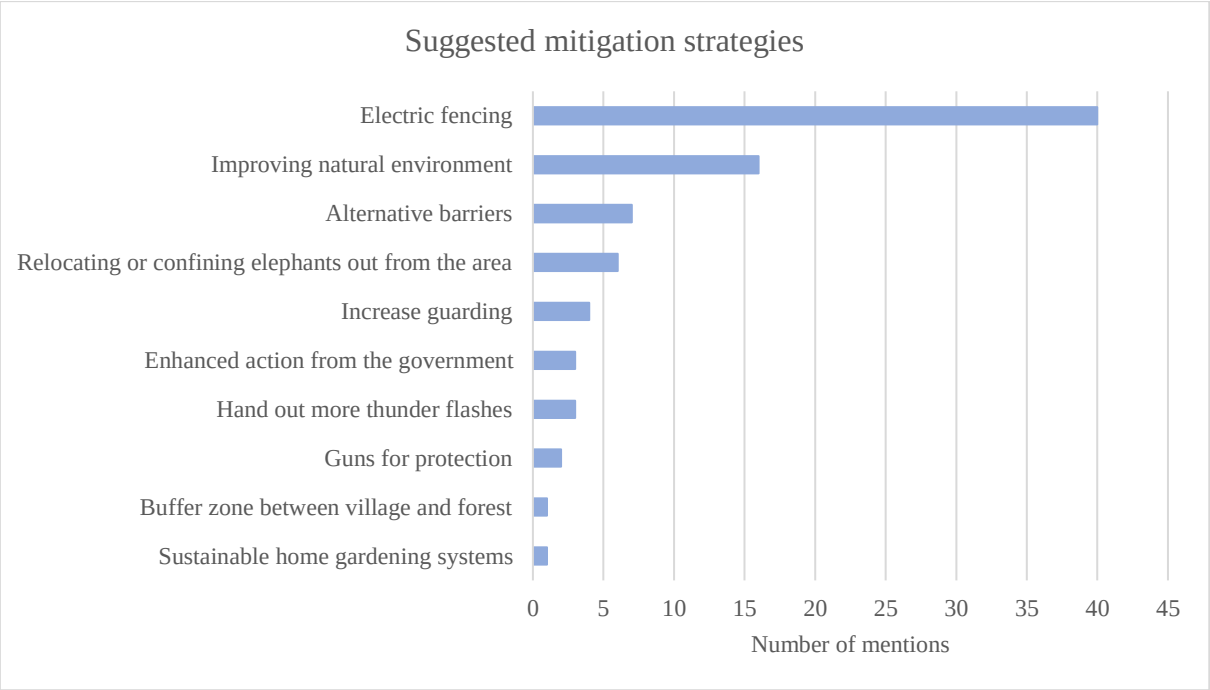

Figure 17. The mitigation measures proposed by the villagers. The responses often included more than one idea.

All the mentioned ideas of suitable mitigation strategies are presented in the chart above, partly categorised. The different measures to improve the quality of natural environment were the second most mentioned. The suggested measures aim to intervene in the damaging human activities in the forest area and to increase wildlife's food and water availability. Suggestions to block all illegal cattle from entering the protected areas and to eradicate lantana were repeated in many interviews. Some interviewees also mentioned that there are still illegal chena cultivations that should be ended. Many seemed to share the view that the forest laws should be harder enforced to prevent the encroachment that still takes place in the forest. Besides advocating the eradication of lantana, some interviewees suggested different rehabilitation projects that could include planting of fruit trees and mana and building new water tanks or restoring old ones.

Some farmers were willing to have alternative elephant barriers tested in their villages. Biological fencing with hana bushes or lime trees were mentioned in four interviews. The people who suggested these were aware of their possible limitations like the vulnerability of young plans, and thus told that electric fencing might be needed in the growth phase. Deep trenches besides electric fences were proposed by two groups of interviewees. One interviewee believed that leaving an open buffer zone between forest and the village would also make it more difficult for elephants to enter the villages because they are scared to be exposed in open

spots. Some of the people that we interviewed in the villages close to the Dahayagala corridor demanded that there should be more efficient guarding at the road and around the fence.

Relocation of elephants was supported in six interviews. This concerned normally only the problematic individuals, but in two of the interviews people expressed that by their opinion the elephants do not belong to that area at all but instead they should be confined in protected areas –a view that was generally rare. Some people wanted that their ability to self-defence would be improved by handing out more thunder flashes or even allowing guns in the worst affected areas. Few interviewees did not know what the right measures for solving the elephants issue would be but simply demanded that the government should come up with new strategies. There was one idea that differed from these other, rather conventional suggestions for HEC mitigation strategies. In Kandiyapitawawa we interviewed the head member of an areal farmers' organization who suggested that sustainable home gardening should be promoted in the villages to avoid further encroachment of forest lands. Important for this would be to simultaneously secure sustainable markets for the products that are harvested from the gardens.

Following the question of supported mitigation measures, we asked the interviewees who they think to be responsible of the alleviation of the elephant issue. As expected, most people replied that DWC, or the more generally the government, is the responsible one as it is their duty to take care of the wild animals. Some also mentioned that the villagers do not have the needed resources to handle the issue. But the role of the villagers was also sympathised in one fifth of the interviews. In most of these it was told that the villagers are responsible together with the government officials, either because their actions have led to the situation or because they are better positioned to counter the issues. As electric fences currently have such a high importance in HEC mitigation, we included a more specific question about the responsibilities to maintain the fences. By this question we were partly interested to find out how willing the locals would be to partake in the maintenance work, as community participation has been proposed in the national conservation policy. Here we used a predefined set of answers: DWC, the villagers only, both together, or some other actor(s). Most of the interviewees stated that both DWC and the villagers together should take care of the maintenance. A bit less popular was the opinion that DWC has full responsibility, and only in six interviews the people concluded that the villagers alone should maintain the fence. Couple of the interviewed groups told that they are content with the work of the civil security force in maintaining the fence.

6.5. Key informant interviews

This chapter presents the key informant interviews that were made during the field study. The interviews with the key officials were planned beforehand as their knowledge together with their perceptions of the challenges of HEC are vital for this study. They are the expert source of information on wildlife and the natural environment. In addition to this, the interviewed officials represent the departments responsible of the management wildlife and natural habitat. Therefore, besides hearing their expertise on the issue, we aimed to understand what are the challenges that these actors are facing in relation to HEC management. We also wanted to find out how aligned the views of these actors are with the perceptions of the villagers, or if there are some notable differences of opinion. The other two key informant interviews were carried out more spontaneously after we found out that there was a chance to meet these people. The head member of Welioya's farmers' organization could well represent the combined experiences of the farmers in that area. And the interview with the civil security force personnel gave us insight of the challenges in their work of maintaining the fencing and guarding in the corridor area. Instead of presenting these results in common themes, I have decided to present them an interview at a time as in the end the interviews were quite different and adapted to the position of each interviewee.

6.1 Head staff member of Udawalawe

The head staff member of Udawalawe national park was interviewed to gain better understanding of the elephant population and the state of their natural habitat. The national park constitutes a main part of the regions elephant habitat which connects to Bogahapalassa and the greater area of Bogahapattiya. DWC had carried out a survey in 2011 that estimated Udawalawe's elephant population to be around 600 individuals, but more recently there has been an independent research that concluded that the actual population might be even double this size. At least part of these elephants utilizes the area of Bogahapattiya, moving between the different forest areas around the year. However according to the interviewee, elephants have not been studied in Bogahapattiya and therefore there is no clear understanding of what kind of population lives there. It is known that some elephants have traditional trails that they follow in Bogahapalassa. Another thing that came up when I asked about the significance of this area for the elephants is that there is an important saltlick somewhere west from Bogahapalassa. The routes to there go through the forest reserve.

According to the interviewed staff member there are especially big male elephants in the northern parts of Bogahapalassa. They typically move to Udawalawe during the mating season that lasts around two to three months. The interviewee told that there is no single season for this, as individual males become ready for mating in a bit different times. Dry season seems anyhow to be the most usual time for this. There is bigger number of elephants in the park in dry season when food and water become scarce in forests. This time of the year the elephants gather to the large tanks in Udawalawe that still hold water and food around them. It was unclear if this seasonality affects the number of elephants in Bogahapattiya. When I asked how the elephant population has developed in the past years, the interviewee replied that it has been growing and that the carrying capacity of the national park is starting to reach its limits. Later in the interview he also mentioned that the problems with elephants have grown. The number of injuries and deaths, both elephants and humans have increased in the past years.

The staff member's answer to the question about HEC's causes reasserted many of the views that the local villagers have. The root cause is the lack of food and water in the natural habitat. Human settlements have been expanding in the area causing increasing burden on the natural environment. Besides this, the illegal cattle and spreading of lantana have been diminishing the food and water availability. According to the interviewee, one third of the national park has been invaded by lantana. The park officials have been carrying out a program to eradicate it in the park area, but this work is challenging because lantana spreads so rapidly. Illegal cattle are also not just an issue in Bogahapalassa, but there have been massive herds grazing inside of Udawalawe. Besides competing of the same food and water with wildlife, the cows' excrements have polluted some waterbodies to the extent that they are now avoided by elephants. Udawalawe's staff was told to have been tackling this issue by removing the cattle from the park area. The interviewee also mentioned that crop raiding occurs because elephants know how to break electric fences and they are attracted by the crops that are grown in the villages. He agreed with the view that elephants prefer some of these crops over their natural diet and that some elephants have become habitual crop raiders. For example, there is sugarcane plantation on the south side of Udawalawe where elephants encroach every night.

The interviewee also confirmed that elephants' crop raiding is an issue around the year. There are two seasons when this happens somewhat more frequently than in other months. One is the dry season like pointed out by the villagers. According to the interviewed staff member August and September are the most problematic months. The other season when elephants cause more trouble is the harvesting time of rice in the beginning of the year. The elephants are especially

attracted by the ripe paddy fields. Most of the house damages happen after, during a festival season in April when the recently harvested rice is stored in homes. The interviewee was not well aware of the HEC situation in all Bogahapalassa, but when asked what the most problematic areas are we were told that most of the issues take place around the corridors, including Dahayagala.

Most of the discussion about current methods to prevent crop raiding centred around electric fencing. The Udawalawe's interviewee recognised the issues that were often reported in the villages. He told that the system of solar powering has not generated enough power to all parts of the fence. The fence does not have strong enough voltage in the parts that are far from the power stations. The head staff member called the fences 'psychological barriers' meaning that they can block elephants for some time, but eventually they learn how to break them. Thus, he believed that electric fencing in their current form can be only a temporal solution. The lack of personnel and resources by DWC was also recognized as a problem which leads to the fences being badly maintained. Part of the maintenance responsibility has been passed to the civil security force, but the interviewee told that they are also missing sufficient resources needed to maintain the fence.

The discussion of electric fences led us next to talk about biological fencing. We were told that they have been tested in different parts of Sri Lanka, and that there is now two kilometres of citrus tree fencing planted in Udawalawe. It is going to take more years before the trees are big enough to work as a barrier, so it is not yet known how these will work. Trenches have been dug in the park too but the problem with them is that they break easily during the rain reason. The interviewee also knew that beekeeping has been tested as deterrence somewhere in Sri Lanka based on the experiences of them being used in Africa. According to the him the problem with this is that the bees and the elephants in Sri Lanka behave differently than in Africa, and apparently the results from Sri Lankan experiments have not been promising. Nevertheless, he thought that beekeeping could be tried at the borders of villages, also because honey production brings economic benefits.

The interviewed staff member knew that the typical deterrence methods used by the villagers are not always effective against the elephants. Sometimes they will not leave the fields before the DWC officers arrive. Like some of the villagers, the interviewee also believed that elephants recognise the DWC officers and at least the sound of their gun. He also mentioned that often when that villagers chase the elephants away only from their own fields, the elephants then

simply move to the next ones nearby. The personnel from DWC on the contrary always drive the elephants out of the villages back to the forest.

When asked about the possible solutions to human-elephant conflict the head staff member first replied that the concept itself should be given up. Instead we should talk about co-existence as the concept of conflict fortifies the idea of elephants being a problem that need to be fought against. He then pointed out to the statement included in the national elephant policy, that conservation is not anymore about protected areas but landscapes. This means that conservation needs to be applied also outside of national parks, in the Managed Elephant Ranges (MERs) as termed in the policy. The protected areas alone cannot sustain the elephant population and thus the other landscapes should also be managed so that they can harbour elephants. The rehabilitation of natural environments was also considered important. One key thing is to eradicate lantana and advance the growth of edible plants. The interviewee supported the current way of placing electric fences on the village borders and not on so called wildlife borders that define the edges of wildlife habitat. This way the fences are easier to maintain and the actual living space for wildlife gets bigger. The interviewee also talked about 'rural' and 'urban' elephants. With the later he referred to the problematic individuals that are repeatedly coming to the village areas. According to him 95 percent of the problematic elephants are individual males. The staff member suggested that there should be research carried out to identify these individuals that could then be relocated into special natural parks that are strictly enclosed. These natural parks contain complete wildlife habitats that are big enough so that the elephants can be confined solely in them. The challenge with these parks is that they are very expensive to maintain, but according to the interviewee DWC is partnering with World Wildlife Fund (WWF) that can provide funding.

6.2 DWC officer in Kalthota range

The DWC's officer in Kalthota could not say how big of an elephant population lives in Bogahapalassa. The population sizes are hard to estimate and apparently there have been no studies made in this area like pointed out by the chief warden of Udawalawe. There are anyhow elephants in the forest reserve around the year, with the number of them increasing during the dry season according to the officer. Crop and other damages also occur year-round. The officer told us that in Bogahapalassa there are no significant differences in crop raiding frequency between of the seasons, but damages are reported especially when the paddy is ripe. He did not

mention that dry season would be different from the other months as told by most of the other people that we interviewed. When we asked if there are any areal differences in the frequency of elephant encounters or in the causes for the conflict, the officer told that HEC occurs in all parts of Bogahapalassa without any areal differences. He stated that the issue with elephants is severe and that DWC receives contacts every night about elephants being in some of the area's villages. It was told again that in most cases the crop raiding elephants have been individual males.

The DWC officer told the causes for the elephant issue to be same as were described by the Udawalawe staff member. The villages have expanded to the detriment of forest areas. This has partly happened through illegal encroachment and land grabbing. Some villages are now located on the traditional elephant routes and thus the elephants keep on coming there habitually. There is no longer enough food in both Udawalawe and Bogahapattiya because of lantana and the illegal cattle, in addition to the shrinking of forest areas. According to the DWC officer big part of elephant habitat was lost also due to the big development projects that took place south from Udawalawe. Apparently the officer referred to the Mattala Rajapaksa International Airport that was opened in 2013 and to a harbour that had been constructed in the same region.

The ways how DWC tries to mitigate the elephant issue in the area were told to be the following. The main strategy is currently to build the electric fencing around the villages. DWC also distributes thunder flashes to the villagers, two for each family. When DWC is contacted about an elephant being in a village their personnel go there and drive the elephants back to the forest. The problem with this is that there are currently only five staff members working for the whole range and they have only one vehicle to use, so they cannot always respond to the villagers' requests. We also asked about the compensations to confirm the current state of the scheme. The officer confirmed that crop losses are not compensated.

When asked about the biggest challenges in mitigating HEC, the officer replied that to be the maintenance of electric fences and getting them to cover the whole forest reserve. According to him it is going to take at least two more years before all the villages have the fence. The resources are very limited and thus the process is taking long. The officer told that the issue with the fences maintenance is that elephants know how to find the weak spots in the fence, like badly erected pole, and easily break them. He did not mention the lack of power or any other issues. According to the officer parts of the fence are managed directly by DWC, part by

civil security force, and some by villagers. When asked about the performance of the typical deterrence methods used by the farmers, the officer replied that sometimes they work but at times elephants are not scared of them.

As electric fencing cannot be thought of as a final solution to HEC, at least not on its own, we asked the officer what the long-term plans of DWC are to tackle the elephant issue. According to him there are no plans other than to advance the electric fencing. Other strategies are still to be waited for.

6.3 FD officer in Nikapotha beat

The topic of HEC was shortly discussed in an interview with the Forest Department's officer in Nikapotha beat. Although Nikapotha beat covers only the eastern part of Bogahapalassa, the FD officer is naturally familiar with the whole forest reserve. When we asked how the elephants use the Bogahapalassa forest the officer replied that they are there the whole year and not just in some particular areas but around the whole forest reserve. He believed that elephants first started to come to the villages as their natural food sources had diminished. Now they come even if there would be sufficient food in the forest because they are so habituated to crop raiding.

The officer told that the villages of Welanwita and Kumarathanna that are in the middle of the forest are most affected of the elephant issue. The situation was especially bad when these villages were still cultivating sugarcane three years ago. Now when they have changed from sugarcane to pepper there have been less problems with elephants. According to the officer the HEC situation is getting worse in some villages because the young are moving to towns and have their own cultivations there. Because of this change there are less people guarding the fields of the families that have stayed close to the forest.

In the end of the interview I shortly asked the forest officer if there are any livelihood development programs carried out as suggested in the forest plan. He told that cultivation of pepper has been promoted by distributing pepper seeds in some villages, and some people have been granted permissions to collect non-timber forest products in Bogahapalassa.

6.4 Head member of the main farmers' organization of Welioya

We started the interview with the head member of Welioya's farmers' organization by asking what are the most important problems that the farmers face. According to him the biggest challenge is the lack of water in the dry season. The encroachment that has been going on in the upper side of the catchment area has party caused the shortage of water. The seasonal rains are also not that predictable anymore, and their delay causes problems. After this come the problems with elephants. I also asked the interviewee what the most problematic pests are. For this he replied squirrels, monkeys and elephants, of which the elephants do most of the damage. They were told to cause damages around the year, but like in the other interviews, the interviewee stated that dry season from May to October and the harvesting season from January to March are the worst for crop raiding. The villages and families that are the most affected are the ones close to the forest border. The interviewee told that elephants do not usually get further than 500 meters away from the forest as they are chased back already in these areas.

Besides crop losses, there have been a lot of property damages and five people have died and 20 injured in elephant attacks in the past two to three years around Welioya, according to head of the organisation. Elephants have also been injured and two of them killed in the past two years. The interviewee told that farmers are getting angry to elephants, and some are even resorting to guns or using hakka patas traps against them. He believed that the lack of sleep occurring because of the need to guard the fields is making people even more irritated.

The farmers' representative's views of the causes for the elephant issue were largely the same as what the villagers from that area had told us. Population growth has led to reduction of forest area. Lantana has further reduced fodder availability. There is shortage of water sources in the forest. He also shared the believe that the elephants that have been released from the elephant transit home are key part of the problem, and that there are other elephants too that have been brought from elsewhere. The interviewee also stated that there are illegal mining and tree felling happening in the forest which partly increase the problems. Besides these developments, the increase of human and elephant populations in the area has intensified the HEC by his view.

The main information that came up in the village interviews about the preventive measures used in the villages was backed up by the interviewed member of the farmers' organization. Firecrackers and thunder flashes were deemed to work best against elephants and the already familiar problems of DWC's electric fence were yet again mentioned. The fence was

nevertheless still seen as important preventive measure if the issues with power shortages could be solved. The interviewee also suggested that biological fencing would be tested at the forest borders and told that they have even requested this from DWC and FD.

6.5 Civil security force volunteer

The member of the civil security force was interviewed at the guard post on the western side of Dahayagala. He told that there at the corridor elephants break the electric fence every night, often with branches or trees. They might first break in from one spot, then people chase them back, after which they break in again from another spot. According to the interviewee there are at least seven break throughs per night. Each staff member has their own parts of the fence to check and repair. Normally it takes from half a day to full day to repair the fence from the previous night.

The interviewee said that elephants enter the villages also from the open spots on the road every night at least on one end of the corridor. There is one male elephant that was told to walk on the road every evening between 6 and 9 pm. There are two volunteers guarding the open spots at the road nightly, but they are powerless against the elephants. The interviewee said that sometimes they try to scare the elephants back with thunder flashes, but they do not have enough of them to keep the elephants away. He believed that they are anyhow useless and that only guns could stop the elephants. The guards used to report to DWC immediately when there was an elephant intruding to a village but according to the interviewee they do not do this anymore as the help from DWC have not been available. Now when there is an elephant walking through the road to a village the guards just watch and do nothing. When asked if they even try to inform the people in the villages they said that it is useless as the people know anyhow that elephants will come. Based on this interview, the situation at the corridor seems highly problematic.

7. Conclusions

The results of this study show that human-elephant conflict takes place in the whole area of Bogahapalassa and the villages adjacent to Dahayagala corridor. Elephants raid crops and create other issues around the year with little seasonal variation. The damage and threat that they cause

can have heavy burden on the lives of the farmers in these primary agrarian villages. Most of the villagers seem to feel that the troubles caused by elephants seriously hamper the lives of the affected families or even their whole village's. The typical long-term development trends that have worn down natural habitats around the world are largely behind the conflict also at Bogahapalassa. Together with some locally specific drivers the situation has evolved so that elephants now commonly transgress the border between human and wildlife areas, seeking food and water from the villages. The views of the villagers and officials of the causes of HEC largely coincide as do the perceptions of the possible solutions. The current mitigation strategies are clearly not sufficient as the traditional deterrence methods are losing their power and electric fencing suffers constant deficiencies. Lack of resources is complicating the situation, being a challenge not only for the villagers but also for the DWC. Although electric fencing is strongly supported by the villagers and advocated as the main mitigation strategy by the wildlife officials, more is needed and wanted. As put forth in the national elephant conservation policy, multi-pronged and long-term strategies need to be introduced. The deficiencies of current methods suggest that new strategies should be tested. I will next conclude these findings, that share many similarities with other HEC studies, in more detail.

As typical for many human-wildlife conflict sites the expansion of human settlements, agriculture and other activities to the detriment of the forest area has characterized the past development at Bogahapalassa and its surrounding areas according to the interviews. The decrease in elephants' habitat has made their food and water sources scarcer while their traditional territories have increasingly overlapped with human areas. It was commonly understood by the villagers and the interviewed officials that this situation compels elephants to enter the villages in search of water and nutrients. The expansion of human settlements has blocked elephants' access to areas that they have traditionally used. Most of the village expansion and encroachment of forest areas has presumably halted after the declaration of the forest reserve but like evident from the interviews some human activities still take place in the protected areas, many of which illegally. Illegal cattle crazing seems to be one of the main local challenges for the conservation of the remaining forests. Livestock competes with elephants of same food and water both in Udawalawe and Bogahapalassa. Another main factor that is believed to diminish the availability of mana and other eatable plants is the outbreak of lantana. It is unclear how widely it has spread in Bogahapalassa. In Udawalawe it has invaded as much as one third of the park's area. Experiences in the natural park point out the difficulty of controlling this rapidly invasive species.

Many of the villagers and the key informants believed that HEC ensues also because elephants simply prefer the crops grown by humans because of their better taste and easy availability. The proximity of agricultural areas to the protected area borders contributes significantly to this. There are signs of some individuals or groups becoming habituated to crop raiding, which if becoming more common can increase the problems that the farmers face. Similar findings have been made in other HEC case studies that I have referred to in chapter 2.2. The observations of Udawalawe's elephants and their habit of raiding nearby sugarcane fields also point to the possibility that part of crop raiding can happen routinely even if the protected areas would hold sufficient food sources.

Studies of elephants' crop raiding have shown that it is typically only part of the population, mostly individual males, that raid crops. The observations of Udawalawe's staff point to the same understanding. Because of the difficulties of identifying elephants in the darkness the interviewed villagers could not normally tell if same individuals have entered the villages repeatedly. However, part of the villagers and the civil security guard that we interviewed knew to say that there are some elephants that come to the villages often. Whereas other perceptions of the causes of HEC coincided largely between the different stakeholders, some villagers had quite specific ideas of the problem causing elephants. In part of the villages close to Udawalawe the interviewees believed quite commonly that the problematic elephants are particularly the ones that have been released from the elephant orphanage or brought from elsewhere. It was seen problematic that the elephants that are used to interact with humans and get to eat fruits and other food from the villages are released to Udawalawe from where they roam to the villages without being afraid of humans. As elephants are known to get habituated for example to crop raiding and to different deterrent methods, it is plausible that continuous human presence and certain diet in the orphanage could make them at least less afraid of people and possibly even more prone to crop raiding. The tendency of ex orphanage elephants to enter human areas could be an interesting and worthwhile topic for further research.

The villagers' perceptions of HEC's causes and solutions communicate indirectly their perceptions of elephants and their conservation. It is interesting to notice that there is a strong sense of the villagers themselves or the human-induced development in general being the cause for the situation. Simultaneously it is commonly understood that elephants belong to that area and that at least partly their crop raiding happens just because they need to fulfil their nutritional needs in an environment of limited resources. One interviewee summarised this idea by saying that humans can always go to other places and find their ways to get by, but the elephants belong

to this area and they need to eat too. Attitudes against elephants' conservation per se were practically missing in our interviews. Most of the perceptions supported an idea of protecting villagers' livelihoods by blocking elephants' access to villages while conserving them in the protected areas. However, it should be kept in mind that the presence of CEJ's staff in many of the interviews can have partly affected people's answers in a way that more critical opinions were not expressed. Although being rare, there were also signs of some people retaliating against elephants. The use of hakka patas implies that some farmers are ready to resort to more extreme measures if crop raiding cannot be stopped otherwise. While the developments in the villages were understood to largely cause the issues with elephants, the responsibility of solving them was mostly seen to belong to DWC or the government in general. This is typical in HWC cases in which protected species are involved. However, in one fifth of the interviews the villagers also stated that it is at least partly their responsibility too to take part in solving the challenges. This suggests that the communities could be incorporated more closely in the mitigative and preventive activities.

Elephants clearly cause considerable trouble for the local farmers who face both the typical direct and indirect costs of HECs. Similar to other HEC sites, elephants have caused damages to a wide variety of crops. The widely cultivated crops of rice, banana, coconut, cassava and corn appear to be the most prone for crop raiding. On the other hand, pepper, lime, orange and cinnamon cultivations seem to mostly avoid losses. House damages were also common in the area. Injuries and deaths have not been avoided either. In most areas losses and damages were reported to happen around the year to a different extent. Because of this crop protection efforts are needed year-round. The driest months around July to September and the harvesting season in the beginning of the year are the most problematic times in most villages. The threat of elephants poses also certain restrictions on the lives of the locals. Besides complicating the everyday lives of many villagers, for example by restricting their free movement, the presence of elephants can have significant opportunity costs for some farmers that need to invest time in guarding or money in other crop protection methods, or that cannot cultivate certain areas or crops because of frequent crop raids.

Based on the interview data it can be said that HEC takes place in the whole study area. However, the interviews were weak in disclosing the possible areal differences in the occurrence of the conflict. Our results suggest that the level of HEC is high in almost all the villages except the three villages of Kandiyapitawawa, Parakumbayaya and Dehilanda where there might be less issues with elephants. Yet ascertaining comprehensively the real differences

between areas would require further research as our interviews captured only villagers' perceptions, which have potential of being either exaggerative or moderate depending of the respondents. To limit the possibility of bias more interviews would have been needed. The one to four interviews per village could not always well define the HEC situation in each village but together they formed a mutually supportive material that was better in defining the situation in general at Bogahapalassa.

The elephant issues in the area are currently being addressed with a range of traditional deterrence methods and increasingly with electric fencing. The interviews showed that all these tactics are suffering from various deficiencies, similar as in other HEC studies. The problem with the traditional methods like shouting and using torches and firecrackers is that many elephants are getting increasingly habituated to them and thus cannot be driven away that easily anymore. Even thunder flashes seem to be losing their effectiveness based on the stories of elephants simply ignoring their loud bang. Thunder flashes were anyhow considered useful by most interviewees and there was even a demand to have more of them from DWC. In the areas where crop raiding happens repeatedly it is likely that families can easily run out of thunder flashes. As farmers should be able to protect their fields from crop raiding elephants it would be rightly for them to have an easy access to thunder flashes. It should however be considered if bigger distribution of thunder flashes can lead to a situation of them being used so commonly that elephants become even more 'immune' to them. The key in the HEC mitigation is that no single tactic gets overexploited, but instead multiple methods should be used.

The compensation scheme for HEC losses seems to face administrative issues that cause slowness in the process. The most interesting problem related to the scheme was however that many of the villagers seemed to be misinformed of which losses are actually counted in the scheme. Although crop losses are not compensated anymore most of the interviewees still believed that they would be. This seemed to cause frustration towards DWC as people believed that their crop losses would be covered but in the end did not receive any compensation.

The problems with traditional mitigation strategies must have partly contributed to the wide support of DWC's electric fencing. It was seen as an important measure in tackling HEC even though simultaneously the current realization of the fencing faced much of critique. In those southern villages where DWC's electric fence has already been taken in use the interviewees reported of similar issues as those that were mentioned in Gunaratne's and Premarathne's (2006) research of electric fences in Sri Lanka. The main issues are poor design and

maintenance of the fence. The issues with the lack of electricity and easiness to break the fence should be addressed in the design of the new fences that are constantly being built. Better design of the fence would also lessen the maintenance workload. Currently the fences seem to get broken so frequently that it is challenging for the actors responsible of the maintenance to fix all the breakages promptly. The interviews also revealed that the lack of DWC's and civil security force's resources can be another major thing impeding the maintenance work. In this situation alternative ways of arranging the maintenance could be considered. As proposed by Parker et al. (2007) and the national policy for the conservation of elephants, community participation in the maintenance work can possibly yield better results. Though this would require investment in the training of the villagers and as mentioned in the policy a full-time officer would likely be needed to coordinate and supervise the work. In a long run granting the ownership of the maintenance to the villagers could possibly anyhow turn out to be the more sustainable option. The interview results indicate that the villagers could be willing to take part of the maintenance if it would be done in cooperation with DWC. The communities alone cannot or are not willing to afford the maintenance.

Even if the issues with electric fencing would be solved, it alone cannot be the solution to the HEC. The experiences with electric fencing have shown that it is mostly a short-term solution. From the conservation perspective it is also unsure if the elephants can simply be confined in the forest areas if at the same time the heathy populations are to be conserved. Like pointed out by the representative of Udawalawe and the national conservation policy, protected areas alone are not sufficient to uphold large populations, at least when the natural habitat has deteriorated. Thus, other mitigative and preventive, short- and long-term strategies are needed. Long-term solutions seem to be currently missing from Bogahapalassa as evident in the interview with DWC. On the other hand, different habitat enrichment efforts and trials of alternative mitigation methods with biological fencing are being carried out in Udawalawe. Similar measures that would tackle the issues of illegal cattle grazing and lantana outbreak would be needed in Bogahapalassa. Other rehabilitation project like building water tanks in the forest as suggested by some interviewees could also be considered. Different adaptive measures in the villages can likewise be vital in the conflicts solution. Contrary to uncontrolled village expansion and development, land use planning that considers the elephant issue should be realised. For example, planned location of crops so that the ones that do not attract elephants are placed closest to the forest border, thus creating a buffer for other crops, could decrease the inducement of elephants to enter these fields. Where possible, incentive programmes that support either

alternative livelihoods or cultivation of crops like lime, chillies, orange or pepper over the ones that are frequently raided could also be considered. These could possibly be incorporated in the livelihood development programmes run by the FD. Identification and translocation of problematic elephants like suggested in Udawalawe might be needed in the cases of continuously problematic individuals. The identification process could simultaneously address the possible issue of the orphanage elephants being potentially more problematic than the rest of the elephant population.

The challenge with the above-mentioned mitigation strategies is that they are normally expensive to realise. Especially in the context of economic constrains sustainability is an issue for many common strategies. The obvious lack of resources allocated to HEC issues suggest that it can be difficult to successfully implement any of the longer-term strategies at Bogahapalassa. Thus it seems that the local management institutions, DWC in front, should be strengthen to make them able to effectively address the issues with elephants. As pointed out by Naughton-Treves and Treves (2005) without well-functioning institutions it is hard to manage human-wildlife conflicts even if the used approaches were otherwise adequate. This study can only present some suggestions of the mitigation strategies based on our limited findings. More research is needed to find out what are the locally most suitable multi-pronged options for human-elephant conflict mitigation at Bogahapalassa.

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Appendix

Base for village interviews

Basic information

1. Village name:

2. Coordinates of the interview location: North latitude: Nº' East longitude: Eº'

3. Date of the interview (DD/MM):

4. Number of men and women

5. Ages of the interviewees:

6. Description of occupation or position in the community:

7. Interviewer code:

Livelihoods

8. What are the main sources of household income? How important are they:
   2 primary source for most
   1 secondary source, or primary just for some

	importance
1) Subsistence farming	☐
2) Farming of cash crops	☐
3) Agricultural wage labour	☐
4) Livestock	☐
5) Timber, mining or quarries	☐
6) Collection of NTFP	☐
7) Governmental jobs	☐
8) Jobs in private sector, i.e. store keeping or construction	☐
9) Other:	

9. Which type of agriculture is practised in your village? What are the two most common types?

1) Chena (shifting cultivation)
2) Permanent, non-irrigated paddy
3) Permanent, irrigated paddy
4) Other permanent crops
5) Home gardens
6) Other:

10. What crops, trees and other plants has been grown in the village in the past 2 years? Are these mostly sold or used at home? Which are the most important plants for most of the families?

Mark the crop, tree or plant farmed in the past 2 years	**Used mainly at home**	**Sold**	**Important ones**
a. Paddy			
b. Corn			
c. Cashew			
d. Sugarcane			
e. Cassava/Manioc			
f. Finger millet (Kurakkan)			
g. Cinnamon			
h. Banana			
i. Coconut			
j. Pineapple			
k. Orange			
l. Mango			
m. Papaya			
n. Beans			
o. Peanut			
p. Rubber			
q. Pepper			
r. Cucumber			
s. Pumpkin			
t. Lime			
u. Chillies			
v. Jackfruit			
Other:			

Impact of HEC

11. How often did elephants enter the area of your village in the past year, based on the cases that you know?

12. Which are the months in which the elephants have caused damage to plants or to other property? What are the worst months for crop raiding?

	most of crop raiding		
1) January	☐	7) July	☐
2) February	☐	8) August	☐
3) March	☐	9) September	☐
4) April	☐	10) October	☐
5) May	☐	11) November	☐
6) June	☐	12) December	☐

13. What is the most problematic time of the day regarding crop raiding?

14. Which plants have been eaten or damaged by elephants in the past 2 years? Were they damaged only when ripe or in some other growth phases?

The plant damaged by elephants	**Growth phase**	**Preferred by elephants**	**Elephants don't eat**
a. Paddy			
b. Corn			
c. Cashew			
d. Sugarcane			
e. Cassava/Manioc			
f.Finger millet (Kurakkan)			
g. Cinnamon			
h. Banana			
i. Coconut			
j. Pineapple			
k. Orange			
l. Mango			
m. Papaya			
n. Beans			
o. Peanut			
p. Rubber			
q. Pepper			
r. Cucumber			
s. Pumpkin			
t. Lime			
u. Chillies			
v. Jackfruit			
Other:			

15. Do you think that elephants like some plants more than the others? Are there some plants that they don't eat? *Mark above.*

16. Do you know if there are any plants that repel elephants? For example because of their repulsive smell.

17. How many families live in your village? How many of them suffered crop raiding by elephants in the past year? If all cases are not known, please give an estimate.

18. How serious would you estimate the crop losses for elephants in your village? Would you say that they are:

0 = none / not significant at all

1 = minor / small amount of plants is lost at times but it does not affect people's lives much

2 = moderate / crop losses are reoccurring and fairly big but families still get along with the remaining harvest

3 = serious / the losses are frequent and they seriously hinder the subsistence of many families

19. Have elephants damaged other property in your village in the past two years? If yes, what kind of property? **1** Yes **0** No

20. Has there been any human injuries or deaths in your village because of elephant attacks in the past two years? **1** Yes **0** No

Injuries:

Deaths:

If yes, can you tell how many and describe the situations in which these happened?

21. Has there been any cases of elephant injury or death in the area of your village in the past two years?

1 Yes **0** No

Number of injuries if known:

Number of deaths if known:

Do you know how these happened?

22. Has anyone in your village applied compensations for:

1) crop losses

2) property damages
3) injuries
4) deaths

If compensations were applied, did people receive them?

23. Are there any activities that people have gave up or avoid because of elephants? For example, are there areas or plants that are not cultivated or some routes that people avoid because of the presence of the elephants?

Perceptions I

24. Why do elephants enter the villages (in general in the larger area)? Are there any specific reasons in the area of your village?

25. Compared to earlier years has the conflict with elephants:

1) Decreased
2) Increased / intensified
3) Remained the same as earlier

26. If 1) or 2), what do you think are the reasons for this?

27. Do you know which groups of elephants have entered the village area? Are they usually the same elephants, only part of the population, that come repeatedly?

Strategies to prevent crop raiding

28. Which measures have been used to avoid elephant incursions into the village? Have they been useful?

Mark the methods mentioned	**Useful**
a. Shouting	
b. Flashlights	
c. Firecrackers	
d. Thunderflashes (large firecrackers from DWC)	
e. Fires	
f. Fencing (non-electric)	
g. Electric fencing by DWC / villagers' private	
h. Electric fencing by private party/company	
i. Noisy objects (i.e. hanging from fences)	
j. Human guarding	
k. Tree houses	
l. Trap guns	
m. Shot at elephants	
n. Requested DWC to relocate trouble causing elephant	
o. Planting plants favoured by elephants in the forest or forest borders	
p. Building water spots for elephants in the forest	
q. Planned locating of crops (i.e. buffer zones, growing plants that elephants avoid in the risk zones)	
r. Beekeeping/playing bee sounds	
s. Other:	

29. If some measures have turned out not to work, can you specify why?

30. If electric fencing was used: What are your experience with electric fences? Do they help to solve the problem? Are there any downsides with electric fences? *Skip if mentioned above.*

31. Do people usually protect farms together collectively or individually each family just their own?

32. Has the Department for Wildlife Conservation been working actively in this area?

Perceptions II

33. What should be done to mitigate the conflict between humans and elephants? Is there anything that could be done specifically in your village?

34. Who should be responsible for mitigating the elephant issue? Is it the villagers, the Department for Wildlife Conservation or some other actors?

35. If electric fences were mentioned above, whose responsibility is it to maintain these fences? *Skip if answer was given in question number 36.*

1) DWC
2) The villagers only
3) Both jointly
4) Other:

36. In your opinion, which of the following measures are the most important in mitigating HEC?

1) Restrict the movement of elephants so that they cannot enter human areas (i.e. with electric fences).
2) Remove all problematic elephants.
3) Limit people's activities (e.g. mining, collection of NTFP, farming) in the remaining forest areas.
4) Improve and maintain elephant habitat (e.g. build water tanks, plant fruit trees or remove invasive spices in the forest).